5365-2
L C
3600

THE AMERICAN GAS LIGHT JOURNAL

REDMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, HEATING, MECHANICAL, CHEMICAL AND GENERAL SCIENCE.

VOLUME LXXXV., No. 1. Whole No. 1,621. | NEW YORK, MONDAY, JULY 2, 1906. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager. THOMAS J. CUNNINGHAM and ELBERT P. CALLENDER, Editors.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

Published on each Monday of the year, at No. 42 Pine Street, New York.

Telephone.—2996 John.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $5 (£1—25 francs).

Remittances should be made either by post office order, express money order registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

Collections are invariably made directly from this office for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

EDITORIALS—

Briefly Told 1

Institution of Gas Engineers—Death of Mr. F. W. Thomas—Notes.

Recent Patent Issues 2

Twenty-ninth Annual Meeting, Western Gas Association—Official Report—Revised by the Secretary—Continued from Volume LXXXIV., page 1105. 2

First Day, Afternoon Session—The Making of Rates and the Additional Business System of Cost, by Mr. W. H Gardiner, Jr.—Discussion—Electrolysis of Gas Mains, by Mr. M. R. Bump—Discussion.

SPECIAL ENGLISH CORRESPONDENCE 12

Association or Amalgamation for Small Gas Undertakings—The Institution of Gas Engineers.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES 13

Verdict Against the Rochester (N. Y.) Railway and Light Company—The U. G. I. Company Secures Control of the Dauphin County (Pa.) Gas Company—Chemung County (N. Y.) Gas Company Changes Hands—Proposed Improvements at Beloit, Wis.—Sale of the Peoria (Ills) Gas and Electric Company—The Southern Gas Company, of Atlanta, Ga., Seeks a Franchise—Mr. F. S. Mayer Resigns—Proposed Reduction at East Boston, Mass.—Franchise for Mount Carmel, Ills.—Franchise Asked for Merrill, Wis.—Suits Against the Sedalia Companies Dismissed—Charlotteville (Va.) City Gas Plant Leased—Sibley, Ia., to have Gas—Franchise Asked for Natchez Miss.—Gas Statistics—Mr. Evans the Lowest Bidder, Richmond, Va.—And Other Items.

The Market for Gas Securities 15

BRIEFLY TOLD.

INSTITUTION OF GAS ENGINEERS.—The annual meeting of the Institution of Gas Engineers, founded in 1863 as the British Association of Gas Managers, was scheduled for Tuesday June 19th, to be held this year at the rooms of the Institution of Mechanical Engineers, Storeys Gate, Westminster, London, England, under the Presidency of Mr. Charles Wood, of Bradford, England. Our special English correspondent, Mr. Norton H. Humphrys, gives, in an article on page 12, this issue, a resumé of the work to be taken up by this meeting and of the many interesting papers to be read by men of wide experience. Just as we are going to press we are in receipt of Mr. Ernest Körting's valuable paper on "The Vertical Retort from a Practical Point of View," too late for this issue, but will appear in our next on July 9th. Mr. Körting is Manager of the Imperial Continental Gas Association, of Berlin, Germany, and Chief Engineer of the great Mariendorf works of the Company. Mr. Körting will kindly accept our thanks for the paper.

DEATH OF MR. F. W. THOMAS.—With deep regret we announce the death of Mr. F. W. Thomas, for many years associated with Waldo Bros., of Boston, Mass., whose death occurred on Friday, June 22d, and the burial was at Peabody, Mass., his old home, on Sunday June 24th. There was a large attendance of New England men at the services. Mr. Thomas was a member of the New England Association, the Guild of Gas Managers, and the American Gas Light Association His genial and social personality won him a host of friends, not only in New England but all over the country. A widow survives him.

NOTES.—

WE are informed that the heating apparatus installed in the bathroom of the Barney S. Kemp house, which resulted in the owner's death, was an attachment for a range boiler, and not an instantaneous water heater, such as is commonly used for heating water for bathroom purposes.

THE St. Louis Gas Construction Company, of St. Louis, Mo., has recently completed shipment of 28 car loads of their high grade water gas linings for the following places: Bloomington, Ind., Columbia, S.C., Grand Rapids, Mich., Austin, Minn., Morrison, Ills., Hartford, Conn., Charlestown, W. Va., Biloxi, Miss., Mobile, Ala., Richmond, Ind., Morristown, N. J.

AT the meeting of the caucus of the Councils of the city of Richmond, Va., Monday, June 25th, Mr. Wm. P. Knowles was re-elected Superintendent of the city gas works. The joint committee on rehabilitating the city gas works met after the caucus to immediately adjourn until the following evening.

THE Council of Macon, Ga., has turned down the application of the Albion Gas Company for a franchise.

THE Gas Company at San Diego, Cal., will make extensive condenser, purifier, holder and pumping installations this year.

MR. G. W. PARKER, Eastern Agent for the Parker-Russell Mining and Manufacturing Company, has gone to Seattle for a vacation. While there he will visit Spokane and other Western cities.

MR. A. H. HAGERMAN has been appointed Superintendent of the Red Bank District of the Consolidated Gas Company, of New Jersey, filling the position formerly occupied by Mr. C. D. Bennett, who has been transferred to Asbury Park, N. J.

MR. J. M. COLES, formerly Superintendent of the Asbury Park District of the Consolidated Gas Company, of New Jersey, has been appointed Superintendent of Distribution of the Long Branch district of the same Company.

MR. H. H. HIMSWORTH, formerly Assistant Superintendent of the Grand Rapids (Mich.) Gas Light Company, has been appointed Superintendent of Manufacture for the Consolidated Gas Company, of New Jersey, at Long Branch, N. J.

LIBRARY OF CONGRESS. JUL 2 1906 SMITHSONIAN DEPOSIT.

TP700
.A5

THE Maryland Meter Company has recently installed an 11-foot station meter for the Consolidated Gas Company of New Jersey, at Long Branch, N. J.

M. J. HIGLEY, representing the Industrial Gas Construction Company, of Chicago, has notified the authorities of Belle Plaine, Ia., that he accepts the franchise which is offered him, under which he will construct a gas plant at that city.

MR. WM. B. TUTTLE, for several years Superintendent of the Consolidated Gas Company, of Long Branch, N. J., has tendered his resignation and has accepted a position with another of Mr. Emerson McMillin's Companies. Mr. Tuttle is well known in Long Branch, where for several years past he has taken an active interest in every movement having for its object the betterment of the city. His many friends in Long Branch regret his leaving the city by the sea, where he has such a wide circle of friends.

THE First National Bank of Worcester, Mass., applied to the Superior Court for the appointment of a receiver for the Haverhill Gas Light Company and the Haverhill Gas Securities Company. The Old Colony Trust Company, as Trustee, is made a party to the proceedings, the complainant claiming that the Trust Company now holds all the property of the Gas Light Company in trust, although the Gas Securities Company still receives all dividends on its 1,470 shares of stock.

WE are informed there will soon be shipped from Trenton, N. J., a complete gas manufacturing plant to Cape Girardeau, Miss., and Trenton workmen under the direction of gas engineer Mr. Frank D. Moses, will go to that distant point and erect the plant.

GROUND was broken June 7th for the new gas company, which has bought the franchise of the Memphis (Tenn.) Power Company. Behind the new organization will be E. G. Cowdrey, Vice-President and General Manager of the Laclede Gas Light Company, of St. Louis, and others whose names are at present withheld. It is announced that cheaper gas will be furnished Memphians.

FOLLOWING the general policy of giving customers the benefit of its enterprise, a sort of showing of profits as one might say, the Lynn (Mass.) Gas and Electric Company will reduce the price of gas to 85 cents on October 1st.

A SYNDICATE headed by S. D. Ferguson of Roanoke, Va., and J. D. Funkhouser, of Staunton, have secured control of the Roanoke Gas and Water Company, which is capitalized in $600,000. The Company owns the only gas plant in the city and owns the water plant that furnishes 95 per cent. of the water consumed in the city.

Recent Patent Issues.

Prepared for the AMERICAN GAS LIGHT JOURNAL by Royal E. Burnham, solicitor of patents and counselor in patent causes, 833 Bond Building, Washington, D. C., from whom illustrations and specifications of any patent mentioned below may be obtained for 10 cents.

820,959. Gas apparatus. Hugh Y. B. Duff, Allegheny, Pa., assignor to A. Q. Carpenter, Joseph Stuart, John McCune, William Y. Cadwallader and G. B. Griffiths, individually and as trustees, Pittsburgh, Pa.

821,258. Gas generating apparatus. Harry B. Rouse, Chicago, Ills.

821,306. Prismatic reflector. Otis A. Mygatt, New York City.

821,307. Decorative shade reflector for artificial lights. Otis A. Mygatt, New York City.

821,308. Decorative glass shade. Otis A. Mygatt, New York City.

821,310. Compound reflector for artificial lights. Otis A. Mygatt, New York City.

821,311. Prismatic glass reflector. Otis A. Mygatt, New York City.

821,323. Apparatus for distilling coals and other hybrocarbonaceous substances. Henry Wurtz, Newark, N. J., assignor to American Chemical Education Company.

821,425. Gas cleaner, Patrick Meehan, Lowellville, O.

821,594. Apparatus for making gas. Leon P. Lowe, San Francisco, Cal.

Trade Mark 52,542. Gas burners and Mantles therefor. Welsbach Light Company, Gloucester City, N. J. The word "Welsbach."

53,026. Gas stoves. William M. Crane Company, New York City. The word "Omega."

823,773. Bill delivery mechanism for meters. Richard W. Gallagher, San Francisco, Cal., assignor to Automatic Meter Company, same place.

823,836. Gas burner. William P. Wieman, Allegheny, Pa., assignor to Empire Machine Company, Pittsburgh, Pa.

[OFFICIAL REPORT—REVISED BY THE SECRETARY—CONTINUED FROM VOLUME LXXXIV., PAGE 1105.]

THE TWENTY-NINTH ANNUAL MEETING, WESTERN GAS ASSOCIATION.

HELD IN CLEVELAND, O., MAY, 16, 17 AND 18, 1906.

FIRST DAY—AFTERNOON SESSION.

The President—We will now take up

THE MAKING OF RATES AND THE ADDITIONAL BUSINESS SYSTEM OF COST,[1]

a paper by Mr. W. H. Gardiner, Jr., of Boston.

Without attempting to state the following considerations in their order of relative importance, I believe that rates should be formulated as a joint product of these considerations: 1. Economic desirability. 2. Sociological expediency. 3. Equity. 4. Legality.

That rate system which is economically most desirable is the system which will give the community the largest volume of proper service over the largest area at the minimum commensurate cost to the community and will at the same time yield a fair return to the corporation—net earnings commensurate with the economic service the corporation performs for the community.

That rate system which is sociologically most expedient is whatever system the numerical voting mass of the community may happen to prefer.

Equity aims at making each individual net rate and all rates collectively equally profitable (as savings and net profit) to customer and company alike. The individual apportionments are sought to be individually made in parallelism with individual costs, these latter being determined as accurately as possible.

In my opinion, equity may be better served by individual apportionments not on the basis of supposed individual costs, but rather on the basis of relative individual values of the service.

Strict legality contemplates the court confirmation of the principles or practices of a rate system as not contrary to the statutes and the common law.

No elaboration is necessary to point the fact that one or more of the above stated considerations will usually oppose the others. For instance, to-day sociological expediency usually points to the use of the uniform rate by meter, because by that system many of the customers are served not only much below the value of the service to them, but also below the cost of serving them, and consequently below that rate at which a purely equitable system would serve them. Custom and lack of knowledge have caused the courts to legalize this system. The fact that it acts directly against the desiderata of economic desirability and equity matters not to the masses. What they now want is the uniform rate by meter. If certain socialistic forces now at work go unchecked by sober sense, we may well expect to be asked to supply service, not on a uniform rate by meter, but free up to a certain minimum. In fact, this is really what now is being done under the uniform rate by meter. The "readiness-to-serve" service is rendered free and only the quantity used is charged for.

In my paper on the "Making of Rates" I have not attempted to deal comprehensively with the questions of sociological expediency or legality. These are peculiar to each locality and State. My thought has rather been confined to the consideration of those factors which, in my opinion, will most equitably bring about the most desirable economic conditions.

I take it that the best interest of a community is most fully met by a public service corporation if the latter gives the community throughout its territory the maximum volume of service at such rates as will best effect this and show the community the maximum saving or improvement over other means. These rates should be reasonable and equitable, both individually and collectively, provided, however, that they do not bear inexpediently on the poor man. The fact that a customer is a small user does not entitle him to any special consideration, but the fact that he is a poor man does, even though he thereby in fact is subsidized and becomes a pensioner on his neighbor or the community.

With this introduction, I would pass over the first three sections of my paper and take up the problem of cost finding (Part IV., page 24).

The "Additional Business" system of costs is an evolution of the Doherty system, an understanding of which is assumed.

Mr. Doherty divides all cost under only three heads: Customer, demand and output. He apparently seems to arrive at his units of rate

1. This paper is an abstract of the complete paper, presented in a 75-page pamphlet, and is the one that was read at the meeting.

charging by dividing each of these total group amounts by the corresponding present number of customers, the number of units of demand or of present capacity and the present output. Assuming that there are no general preparation expenses and charges which cannot be properly and accurately distributed under these heads, he proceeds to charge for extensions of business at his present necessary average rate per customer, per unit of demand and per unit of output. This is like saying that because the present expenses and charges amount to $1.20 per 1,000 cubic feet, $1.20 is a proper and necessary charge for additional sales under a uniform rate by meter.

I differ with Mr. Doherty first, in believing that there is a large volume of general current costs as expenses and charges which are not directly attributable to and do not in any way vary with the number of customers, the capacity demanded or the output sold. They do not increase in any proportion to increases of these variables nor can any savings be made in them if the variables should decrease. They may be found in every department and are sometimes largely an historical accumulation of charges due to previous conditions of the art. General fixed "readiness-to-serve" expenses and charges also exist in large amounts in every department. They are the "standby" costs and are not directly attributable to any of the variables because they are practically uninfluenced by them. The manufacturing expenses of June are more than half those of January in spite of June's output being perhaps less than half as large as January's. From such relations the standby "readiness-to-serve" costs can be calculated and placed in the general costs where they belong. They belong there because they are the essentially fixed "joint costs" not varying with either increases or decreases in the number of customers, the capacity demanded or the output taken.

As a minor difference, I distinguish between the total capacity and the maximum capacity actually demanded and charge the difference under the head of reserve capacity to the "joint costs" for the reasons given on page 57.

If all these general fixed costs are carefully eliminated from each and every department, it will be found that the remaining expenses and charges can be distributed under Mr. Doherty's three headings of customer cost, demand cost and output cost, and that they will appear in such a way that they will increase or decrease in practically exact proportions and over wide ranges as each of the variables increases or decreases. In other words, they will exhibit the net additional costs of additional business.

By carefully following the illustrative tables exhibited in my paper, and also the above stated process of reasoning, it will become evident that we have not only arrived at the net cost of additional business, but we have simultaneously eliminated from each unit of service all apparent costs which would not be affected by its existence or non-existence; that is, we have arrived at a determination of the present amount of the general fixed "readiness-to-serve" joint costs, which are not caused by or attributable to any unit of service, and consequently are not specifically traceable to and attributable to any individual customer.

Incidentally, I may remark that an accurate analysis on these lines need not be revised as frequently as that under any other system which does not deal with the net basic costs of additional business. These other systems deal only with the present averages under one or more headings.

Such an analysis of cost as I have endeavored to illustrate and justify gives us the following data:

	Customer cost.	Demand cost.	Output cost.
Fixed costs not individually apportionable because not individually occasioned:			
Joint costs as { General preparation and standby costs. / Reserve capacity costs. }			

The variable costs appear and disappear practically in exact relations to the individual and aggregate conditions of taking and discontinuing service. They are the specific out-of-pocket costs. No argument is, therefore, necessary to conclude that in equity all these variable costs should be each and every one met in full by those causing them. Otherwise, if A takes service he causes B an expense which would not arise if A did not take service. This is entirely different from B having to pay more than a *pro rata* amount of the joint costs which neither of them directly incurred as individuals, but which must be met by income from the community in order that the service meet its total costs.

With the variable and individually apportionable costs thus individually met there remains for solution the manner in which income shall be obtained to meet the "joint costs."

These "joint costs" from their origin are not attributable to any customer or customers but are necessarily incurred each year by the company for the general conduct of its service of the community. To find the most equitable, expedient and efficient means of obtaining revenue to meet these constant "joint community costs" is, in my mind, one of the most vital problems to-day facing every manager of a public service corporrtion who would best serve the public by his corporation and find a fair return to the latter from the service rendered.

I do not believe that "joint costs" can be apportioned in the individual rate payments so that each of the customers bears his share of the "joints costs" in any parellelism to present individual costs. As Judge Noyes says on page 39 of his book on American Railroad Rates: "The primary difficulty with the cost theory is that it is wholly impracticable. The cost of a particular service cannot be ascertained. We have seen that joint costs represent a very large part of the expenses of a railroad (59 per cent.). Energy is expended for the benefit of the service as a whole and not for any part of it. Constant expenses are absolutely, and fluctuating expenses partially, non-apportionable. The out-of-pocket cost of a particular service may be got at; but this cost is merely an element entering into the rate. Any attempt to use these ascertainable expenses as a basis for estimating the whole cost of a service would merely end in conjecture. As said by General Alexander, 'Results so arrived at would be as unreliable as the distance to the moon, estimated by measuring to the top of the highest mountain and guessing at the rest.'[1] Basing rates wholly upon the cost of service is impossible, because it is impossible to find out what the cost is."

With the cost theory thus disposed of as impossible even if desirable, I am forced to the other extreme limit of price making. I believe that "joint costs" can be most equitably and efficiently met by charging them in relation to the individual, class or group value of the service. Some would call this "charging what the traffic will bear" and would interpret this as "charging the last cent the people will stand without rioting." I mean rather "not charging joint costs" so that any total individual rate exceeds the value of the service, the value and charge being, however, at least equal to the out-of-pocket costs." Do not charge what the market will not bear.

"Joint costs" which are not attributable in any way to any individual customer should be met in such a way as to act in the least restraint of trade. To do this they can best be charged where the service is most valuable and should furthermore be charged in such individual amounts that, in so far as possible, each and every individual trade shows individually and collectively equal profits and savings to both the company and the customers. This involves not only "not charging what the traffic *will* not bear," but also "not charging what the traffic *should* not bear."

In the text of my paper I cite a few governmental and railroad instances of this principle of rate or charge making. It is really so generally and advantageously used as to require explanation only in the lighting business. This may be because we have until recently considered only our costs and these only superficially. We have never looked at the other side of the balance—the value of the service. If this is carefully considered we will find a ready source whence income to meet "joint costs" can be derived in the most equitable and efficient manner. Admittedly equitable governmental charges are not assessed on the basis of the costs apportioned to or caused by the individual but in most instances entirely on the individual ability to pay. Not the relative cost, but the relative value, of the service should determine its price.

Careful analysis of almost every other form of public and private business will show that worth and not cost is the true basis of price. I believe this to be the basic rate principle which acts in the least restraint of trade. It has been proven to be that principle on which we can do the most business, finding a margin of profit wherever profit can be least onerously yielded. As this system has worked so efficiently in other public services, I cannot but conclude that its effects would be beneficial to both the public and the company if it were applied to the public lighting business. It seems to me that it would facilitate, in fact is necessary, to the maximum expansion of the service which is synonimous with the maximum utility to the public. If the laws of com-

1. Railway Practice, by E. Porter Alexander, New York, 1887, p. 3, from which the following apt comparison is also taken: "The case of a railroad's estimating the cost of doing a particular piece of business is not unlike that of a lawyer estimating the cost of giving an opinion. He has fitted himself for that particular business and, as it were, invested his life in the education and experience necessary to transact it. His time is good for nothing else, and if he is not called upon for opinions it will be worthless to him. He can, therefore, render opinions up to a certain limit almost without cost except for stationery. So a railroad is a large fixed investment capable of furnishing transportation and nothing else. Up to certain limits it can always take additional business without cost except for a very small amount of fuel. The money it receives for the new business above the small *additional cost* is all clear profit. It adds that much to the ability of the road to serve other patrons at low rates."

petitive trade are insufficient, there remains a system of governmental supervision as yet foreign to this country, which will simultaneously effect the minimum equitable price compatible with the maximum service.

But, entirely apart from any question of regulation, to attain this economically desirable end, the problem must be approached from the points of view of costs and of worth or value.

Cost must be analyzed to determine and apportion all individually variable and apportionable costs, and to extract from the total and set aside joint costs.

Worth or individual value must be analyzed to apportion in the community the joint costs in order to obtain revenue to meet it in the way least onerous to the community, the individual and the service.

Rates built upon a system developed from these two viewpoints should have as their bases the individually caused costs and as their maxima the limits imposed by reasonableness, equity and expediency. They should also be simple and of standard or unform form. Differential rates are proper. Individually discriminative rates are not.

I have attempted in this paper and abstract to analyze some of the causes of rates and theoretical means of meeting them. But I must admit that I am not now prepared to give their synthesis in a mathematical rate formula ready for use. I would, however, say that I know of at least one lighting company which is rendering most excellent and efficient service to all concerned, largely because it considered individual and collective worth, as well as individual and collective cost. In its rates, I believe that it has drawn the line between these curves with remarkable accuracy. If this is so, the problem has been solved and is therefore capable of solution elsewhere.

As may have been inferred I am very far from being satisfied with any present rate system or formula. The uniform rate by meter is sociologically most desirable but it is very inequitable and economically very undesirable. The Doherty rate and the Wright demand system are, generally speaking, as equitable as cost rates can be, but may be inexpedient. Between these extremes is the quantity increment system, which sacrifices much of equity and of efficiency to expendiency.

In conclusion, I would, however, say that I believe results can now best be obtained by using a Doherty rate as an optional rate with a uniform rate by meter, keeping the latter as high as may be expedient. By so doing, further discounts may be made only to those entitled to them and can be made to a greater degree because unearned discounts are shut off by a maintained maximum.

Should it ever come to pass that the principles I have advanced in this paper are developed in applicable form, there will, in my opinion, improve even on the demonstrated results of the Doherty rate. But this practical application of my system is fraught with so many intricacies which I have not mentioned that its accomplishment may be long deferred. I therefore do not think that any consideration of it should interfere with the present rapid extension of the Doherty rate. In fact, both the Doherty rate and the Wright demand system have characteristics which would lend themselves with peculiar facility to modifications in accordance with my theories.

Discussion.

The President—You have heard the reading of Mr. Gardiner's paper. Mr. Gardiner's paper has been prepared and sent to the members in book form, and it is assumed that the members have come prepared in advance to take part in the discussion, so that the reading of the paper has been omitted here while Mr. Gardiner has presented you his abstract.

Col. E. G. Pratt—I have already said to Mr. Gardiner, although I was asked to prepare a discussion upon his paper, that, owing to the fact that I had been moving from one place to another, whatever data I had gathered through correspondence and otherwise had not come to hand, consequently I had not been able to prepare myself in the way in which I would like to discuss Mr. Gardiner's paper, even though I felt I was qualified to do it. It seems to me that after a person has given to a subject so much time and so much thought as Mr. Gardiner certainly has in the preparation of this paper, it seems almost absurd, unless someone has given an equal amount of time and has the equal of his ability to do it, to undertake to discuss such a paper, because it seems to me that every proposition he has set up he has pretty nearly proven the justice of the statements. The question of rates and readiness-to-serve rates has been discussed in meetings which I have attended during the last year or two, and it has become quite a familiar subject among the companies with which I am now associated, and there seems to be still a difference of opinion as to the equity of the so-called readiness-to-serve rates. I am sorry that Mr. Gardiner could not or did not deduce from his paper some definite recommendations. If he had it might give us a cue to speak from. I think we have all discovered in recent years that we are doing a great deal of unprofitable business. I presume most companies are supplying from 15 to 22 or 23 per cent. of their customers at a loss, and I think those who have not analyzed their accounts sufficiently would be surprised to find out to what extent this loss goes. The cost lines and the revenue lines, the point at which the cost lines and the revenue lines are crossing each other on variable rates, I know was an astonishing thing to me when it was first presented, and it very soon led us to the belief and the determination that every consumer that we gained was not an advantage to the company, and we felt that it was best for us to introduce some method or some means by which a bonus could be placed upon the so-called profitable business. If the unprofitable business came to us, of course, we had to take it, but our efforts were along lines of profitable business, and our business was so analyzed that we were able to select from different branches of business, different applications of appliances, just what the profitable business was that we should undertake to secure. There is no doubt as to the equity in my mind of the so-called readiness-to-serve method of charging, but I doubt if it could be made practicable in all communities. It might be used, as it is being used now, in some two or three places, optional with the consumer, but if it is left optional with the consumer only the large consumer will take advantage of it, and the small or still unprofitable consumer will refuse to accept or adopt that method of charging. I think that is all I have to say on the subject.

The President—Mr. Eysenbach.

Mr. Eysenbach—Mr. Doherty's discussion do you want?

The President—Will you give us some results of your own experience in Binghamton in the adoption of the readiness-to-serve rate, and then you can read Mr. Doherty's contribution?

Mr. Eysenbach—We have had the readiness-to-serve rate in use now about 8 months, and the trial it has had in Binghamton is not of sufficient length to give a definite opinion. Personally I like the rate very much. We have perhaps 500 of our customers on that rate. It has met with some very favorable comment, both among the consumers and also with our large takers. I feel that it will be up to us before long to convince the Commission that it is a good rate. There will come the real test of the rate. I think the difference of opinion now will largely arise. There are questions of expediency. I don't think there is any question but what the readiness-to-serve rate is the most equitable rate that can be devised, counting simply cost elements. Mr. Gardiner brings up a point that I never thought of in that light before, and that is taking also into consideration the question of worth of service. I think if we are given sufficient time in Binghamton to develop this rate as it should be developed we will win out, that we will get a selling price that will come close to our cost lines on all classes of service, and that we will average less for our gas than surrounding properties and make as much dividend on our investment as anybody. It puts the costs where they belong.

The President—You have a communication from Mr. Doherty.

Mr. Eysenbach—Yes.

The President—Will you read it, please.

Mr. Doherty (read by Mr. Eysenbach)—I have read Mr. Gardiner's paper somewhat hurriedly, but with great interest, and I consider it an extremely valuable contribution on the rate problem and one which will prove of immense value to our knowledge on the subject. There is not a great difference in the opinions I hold and those expressed by Mr. Gardiner. It has been my attempt to show that there are certain factors which cause us expense and that all of our expenses can be divided amongst these three factors with greater accuracy than in the average system now in vogue, and with sufficient accuracy to justify the division. The main difference between Mr. Gardiner's views and my own is his so-called "Joint Costs," which he treats as belonging to no special factor in the expense of supplying service. I am strongly of the opinion that every expense must be due to one of the present known factors, or to some unknown factor which we should be able to locate. In spite of this difference of opinion with Mr. Gardiner, I agree with his conclusion that the question of what the traffic will bear, or what the traffic will not bear, must be considered; whether this is done by having indefinite joint costs which may be apportioned arbitrarily, or whether it is done without this excuse of joint costs and on the theory which the more advanced advocates on the railroad rate problem advocate. This plea for the right to vary charges to meet competition and economic conditions has my hearty approval. This freedom is absolutely necessary to enable the company to give total service to the public at the closest approach of cost to the public to the actual cost to the

company; in other words, freedom to do this permits us to narrow our margin of profits to the benefit of the company by a larger volume of business and to the benefit of the consumer by supplying at lower rates. Any additional business we secure at less than cost to supply contributes its margin of profit to lessen the burden which former consumers would have to bear. In the end the consumer paying the highest rate is eventually the chief beneficiary from the business taken at a lower rate and which could not be secured if uniform rates were strictly enforced. We have certain costs which will not be added to by certain classes of business. While we cannot secure this business and make it bear its proportion of so-called joint costs, we can take this business and make it pay a margin of profit over and above the expense occasioned by taking this business on. This margin of profit can be used to lessen the burdens which are now borne by our present consumers. This, however, the public does not understand and seems to oppose any desire to understand what is a very simple economic problem. This feature of the question should be carefully considered by every gas man. They should organize themselves into an educational body for the education of the public for their own and the public's welfare. I also concur heartily in Mr. Gardiner's comments on the inequity of the uniform rate system. This method of charging is absurdly inequitable and is the chief obstacle against the proper development of business. The cost to supply service depends upon the quantity used by the consumer and the maximum demand made by the consumer in relation to the quantity used. If we sell gas at a uniform rate per 1,000 cubic feet without consideration of these factors, we are compelled to sell at such a high average rate that our business on the whole will be profitable and the rate required is so high that it prevents us from opening up profitable fields of consumption. The maintenance of this rate will mean that our charges must always be in excess of our manufacturing cost; will also mean small sales, and small sales mean a small divisor for the general and fixed charges, or joint costs such as Mr. Gardiner terms them. In using the meter method we base our charges on a single unit, when there are several units which might be used. Let us take as an example the telephone service and let us assume there are two customers, A and B who have telephones in adjacent rooms. Each pays $40 per year for his instrument. A uses his telephone only for emergency service and makes but one call per year. Hence he pays $40 per call. B uses his telephone 2,000 times per year and hence pays an average of 2 cents per call. It manifestly costs the company more to supply B with telephone service than A, because B has everything A has, plus 1,999 calls. In averaging the rate on the instrument basis it means that it must be put so high that few people, who do not have an immense amount of telephone business to conduct, feel able to afford the service. Now let us assume that the telephone company should choose another unit as a basis for their charge, namely, the unit of number of calls. To secure the same revenue in the aggregate from A and B, they would have to charge 4 cents per call, but A would pay 4 cents for his single call and for rental for his instrument for one year, while B would pay $80. Again the inequity is manifdst, A is paying less than he should and B paying more than he should. Let us take a step further and note a distinction between the telephone business and the gas and electric business. In our business the consumer fixes the maximum demand and we must be prepared to furnish this whenever he turns a key or presses a button, and failing to be in complete readiness to take care of his demand in conjunction with other consumers means crippling the service not only to him but to all. Hence our plant and equipment and apparatus to supply that particular consumer must be sufficient to meet his maximum instantaneous requirements, even though it lies idle for every hour in the year but one. On the same basis the telephone user paying on a per call basis could have telephones in every room in his house without increased cost of service, as he would be paying only so much per call. Does it not seem that the telephone company are furnishing really two things: 1. An instrument plus operating conditions which make them ready to serve the consumer; and 2. The service rendered to that consumer. If two branches of service are furnished, should not the charges be made on the basis of these two branches of service and would not the greater equity exist amongst telephone consumers if both paid, we will say, $20 per year for their instrument and the company's readiness-to-serve expense, plus so much per call?

The President—I have a contribution from Mr. H. J. Gille, of the St. Paul Company, which I will ask the Secretary to read.

Mr. H. J. Gille (read by the Secretary)—I have read Mr. Gardiner's paper with great interest and feel that it is a very valuable contribution on rates and additional business system of costs. There is one point that has probably not been given the attention that it deserves, which is in a measure responsible for developing the winter peak business, and that is, time of customers' maximum demand. Net earnings are very largely influenced by the class of business we push, as our costs are based on our ability to supply service which is fixed by the demand on the system at a given time. Therefore, it necessarily means increasing the load factor or working hours of works, equipment and distribution system. If it were possible to sell our product so as to keep our generating and distribution systems loaded continuously that would be increasing the earning power of our investment materially. It is probably safe to assume that the average gas distribution system is not called upon to supply service at full capacity for more than 25 per cent. of the time. In other words, all the gas supplied to the consumers could be supplied in 25 per cent. of the time, leaving our investment in distribution system idle practically 75 per cent. of the time. The same thing is true, only to a lesser degree, of the station equipment. There would seem to me, therefore, ample justification in making a rate to supply service when the investment is not used to take care of the demands of the public. That would be an inducement to develop what might be termed limited service, such service to be limited to the time when the demands of the public are light, in other words, off the peak. I realize that where a uniform meter rate is in effect it would be very difficult to make a rate less than that given to the general public for this class of service.

The President—Is there any further discussion?

Mr. Egner—I read that paper on the way up from Norfolk and was very much impressed by it. I am very glad that a paper is presented to this meeting that has some bearing on a thought in our last published proceedings. This I consider a very valuable paper. The general gas man does not appreciate its value, but if it is included in our proceedings he will have time to see it. I might move a hearty vote of thanks to Mr. Gardiner for his paper.

The President—In just a minute, Mr. Egner, we will give you the privilege.

Mr. Egner—Of course, I mean in due time.

The President—Mr. Norris?

The Secretary—If Mr. Norris will pardon me, I think that Mr. Gille's idea was that the total output in the 24 hours could be supplied in 25 per cent. of the time, that is, if the manufacturing and distribution system were used to the maximum capacity the work could be done in 25 per cent. of the time. It probably applies to the distribution system rather than the generating.

The President—Mr. Gille makes the point, Mr. Norris, that all the gas supplied to the consumers could be supplied in 25 per cent. of the time; in other words, the load factor is 25 per cent. Mr. Walton Forstall.

Mr. Walton Forstall—I do not think, Mr. President, that I can add to what has been said. My work has been that of a distributor rather than a seller of gas.

The President—Did you find it to be a fact that your distributing mains could distribute all of your gas in 25 per cent. of the time?

Mr. Walton Forstall—I have never figured it up exactly, but I imagine that it could. I know that, because our peak load (maximum hour) now occurs in September, being caused by the fact that in that month people are still using their gas ranges, and gas is being simultaneously used for cooking the evening meal and for lighting the house. If the arrangement of our distribution system had not been such that we were able, at a trifling expense, to supply the distribution mains at several places with gas taken from mains used for pumping gas into holders, we would probably have had to spend $30,000 to $40,000 to care for the demand of this maximum hour, a demand which lasts only from about the 15th of September until about the 15th of December.

The President—Is there any further discussion? The making of rates is one of the vital questions before the gas industry, and we must know our subject. Mr. Ramsdell.

Mr. Ramsdell—Mr. President, I have nothing to add. I have never made much of a study of the rate question, and don't think I could discuss it intelligently. I realize it is a very important matter, but I have never been able to go into it yet.

The President—Mr. Gardiner, will you close the discussion?

Mr. Gardiner—Mr. President and Gentlemen, in closing this discussion I would like, if I might take a minute of your time, to try and epitomize the conclusions to which I have been forced. First, my system is essentially the Doherty system. But it has one very fundamental difference from the Doherty system, in that, instead of dividing my costs (and possible rates, perhaps, if I ever formulate a rate system) into only three groups, I divide them into four main groups. One group, known as the "joint costs," is a large fixed body of expenses and charges which do not fluctuate in any proportion to increases or decreases in the number of customers, the maximum demand or the out-

put. Doing this gives me what I might call basic straight lines for the output costs and the demand costs and the customer costs—the net cost of handling additional customers or demand or output. That is a distinct modification from the Doherty rate. The Doherty rate simply takes the three variables, as I call them, and divides the amount of each variable by the present number of customers, or the present output, or the present maximum demand or capacity, and establishes those average costs for each one of those three as the cost or charges, perhaps, to be projected into future business. It includes in perhaps each of the three variable accounts some of the fixed expenses and charges which I set aside as "joint costs." Bearing this difference in mind, I think that the principles of my "additional business" system can be readily understood. The only remaining problem is for a manager to differentiate between his local "joint costs" and each of his net variable costs as customer costs, demand costs and output costs. I realize that the data of many stations is not in ready form to do this, but I believe that the rate problem cannot truly be solved until it is done. Some might find Part V. (beginning page 48) of my paper of interest as a hypothetical case. I would also call particular attention to Part VI., "The Principles of Rate Construction," beginning on page 56. I believe that a study of the value of the service is almost as important as the study of the cost of the service. Both must be considered individually and collectively. The considerations indicated on page 74 seem to me to be also worthy of thought. The question of load factor came up. I want to call your attention to page 28. The load factor of the combined plants whose figures I have used is 33.8 per cent. when calculated on the daily sales capabity. This is very high, indeed, and would be much lower if the maximum monetary capacity were the basis, as it should be.

Mr. Norris—Is that gas?

Mr. Gardiner—That is gas. There is another point which I want to call to your attention before closing, and that is that on page 30 I give a plant operating statement, which we are all accustomed to; manufacturing expenses, distribution, management, taxes, insurance and incidentals, interest, dividends and balance, making essentially the total gross income from the sale of gas. At the Ohio meeting, when the question of accounts was up, I advanced a proposition which I have considered to be sound, with which it seemed to me there was considerable accord in the meeting. What I had in mind was Table 7 of this paper. I want to call your attention particularly, if you have occasion to look the paper over, to Table 7. In that table I apportion the assets of each department; that is, the money invested, we will say, in manufacturing plant to put the gas into the holder. Against those investments I charge the taxes, insurance and incidental charges, interest and depreciation, as items of cost, and I add those to the operating expense of manufacture. The total, it seems to me, gives me the true total cost of the gas in the holder. If you leave out those charges, it is just exactly like saying that the cost of living is the coal bill, the food bill, the wage bill and the light bill, but does not include the rent bill, whether you own your house or not. If you own the house, the rent is simply the interest, taxes and depreciation on the investment. Now, that is just as much a part of the cost of living as the food bill. One reason which led me to formulate this method was that I had had considerable experience with municipal ownership advocates and others of that ilk, who claimed that all excess over bare operating expenses was profit. It is not a profit. Basic interest and other charges on investment are a part of cost. Add that to the operating expenses and you get the total cost. To show you how that works out, the total operating expenses under the old system with these figures was 88 cents, the total cost as stated in Table 7 is $1.20. Of course, the municipal ownership advocate would say that the 32 cents difference was profit if it appeared as interest and dividends and surplus. It is not profit, it is a part of cost. I thank you, gentlemen, for this opportunity of presenting this papar.

The President—I have pleasure in extending the thanks of the Association to Mr. Gardiner for his paper. We will now take up the paper,

ELECTROLYSIS OF GAS MAINS,

by Mr. Bump, of Denver, Col. As Mr. Bump is not present, may I ask you to read this paper, Mr. Von Maur?

Mr. President and Members of the Western Gas Association: In preparing this paper on a subject that has been so extensively and exhaustively discussed before all of the gas and water associations for the past 15 years, it has been my aim to reduce to a compact form the various views on the subject which are now accepted by gas and water engineers. In addition I have aimed to set forth certain facts that, to my knowledge at least, have not received the attention and discussion which they merit.

On the fundamental theory of the electrolytic cell much has already been written. The present theory of the electrolytic cell is the development of an hypothesis set forth by Clausius in 1857. When a salt is dissolved in water and the slightest electric current is passed through the solution, some of the molecules of the salt are broken up to form ions, which are atoms, or groups of atoms, which form the basic and acid components of the salt. The simplest example is common salt, which breaks up into two ions, one of which is the basic ion and is a single atom of sodium, and the other is the acid ion and is a single atom of chlorine.

If an electric current is passed through a salt solution, the basic or metallic ions become charged with a positive charge of electricity and tend to move toward the negative electrode and discharge their electricity upon it. As soon as they are discharged the ions become free chemical atoms and plate themselves upon the electrode as a metallic deposit, this action being commonly taken advantage of in the electroplating industry.

The acid ions in the solution become charged with a negative charge of electricity and tend to move toward the positive electrode of the cell and to discharge upon it. When discharged they likewise become chemically free and active, and if the electrode is a metal that forms a salt with the acid ions, thus freed, the electrode will be broken down to form that salt and will thus be carried off into the solution. It is this latter reaction that usually takes place when an iron pipe is corroded and destroyed by the acid ions in the earth surrounding the pipe.

The correctness of the theory of electrolytic action has recently been challenged by Dr. Louis Kahlenberg, who has gone very extensively into the chemistry of the subject and who presents a long list of arguments based on experiment that apparently disprove the theory. This makes little difference to the gas men, for with the laws worked out he can calculate the effect of the action and this is the point that he is interested in. There are two general laws which govern the amount of electrolytic action, and with these laws the effect can be determined for any particular case. These fundamental laws are as follows:

1. When an electric current is passed through an electrolyte, the quantity of the liquid decomposed—*e. g.*, the amount of electrolytic action, depends upon the amount of electricity, measured in coulombs, which passes through the electrolyte and is independent of the size of the electrode and of the electric pressure applied.

2. When equal quantities of electricity are passed through different electrolytes, equivalent quantities of the electrolytes are decomposed—*e. g.*, a coulcomb of electricity will decompose a certain amount of chloride solution and a different but equivalent amount of a sulphate solution, and these amounts always bear a definite relation to each other.

The first law states that the amount of electrolytic action is independent of the pressure applied. Here is where many mistakes have been made by gas men who have expected to find the greatest electrolytic action where the voltmeter showed the greatest reading between the rail and the pipe. The customary pressure charts of our cities have for this and other reasons very little value except to define the bounds of the so-called "negative" area. The fact that the drop from the pipe to the rail is large indicates that the earth at that point is a very poor conconductor of electricity and that the current flow between the two is small. Often the greatest amount of corrosion is found at points where the difference of potential is almost too small to determine, being only 1 or 2 milli-volts.

The first law also makes it plain that one ampere of current flowing from a pipe will destroy a certain definite amount of iron, whether the pipe is 2 inches or 60 inches in diameter, provided the pipe is in the same quality of earth.

The second law relating to quantities decomposed is stated in a reverse manner from that desired for use of gas men. A given quantity of electricity will decompose a certain amount of iron, if ferric or the higher salts are formed, and another definite amount if ferrous salts are formed, regardless of whether the electrolyte is a chloride sulphate or any other acid. Metals like iron that form two series of salts, possess this quality. For others that form only one series of salts, there is always but one quantity decomposed by a given amount of electricity.

It has been generally supposed and accepted that damage to a pipe occurs only where current leaves the pipe, and in general this statement is practically correct. I am informed by Professor Burgess that it has been proven that in some cases current entering a pipe has caused an acceleration of the corroding action on the pipe. An explanation of this action may be found in the fact that pipes subject to the natural corroding influence of the surrounding earth become covered with a deposit that protects the pipe from further corrosion.

When a current enters the pipe it may destroy the covering thus formed and leave the pipe subject to further corrosion from the surrounding earths.

All of us are familiar with the attempts made during past years to induce or force traction companies to adopt better return construction. First, better bonding was demanded and was in a measure obtained. Next, a system of return feeders to supplement the rail return was added and still the troubles were not lessened materially. Some few cities tried to compel the traction companies to supply the double trolley system, but this has not proven a success. Litigation has been said to have cost some companies more than the damage from electrolysis, but it would seem that it has availed little in forcing the needed relief. As a general rule those companies have fared best that have enlisted the co operation of the traction companies in an endeavor to reduce the damage to the lowest possible point. Some traction companies have paid a portion of the cost of renewing pipes destroyed by electrolysis, but these cases are exceptional. While we have direct current traction, some other means must be found.

At the present time a new factor is entering into the problem and one that happily offers relief to a large degree from the damages caused by electrolysis. I refer to alternating current traction. This new system is giving to the electric traction industry a new impetus, which up to the present time has been confined largely to interurban and long distance lines, but which is destined to come into use in onr large cities as soon as proven practicable on the longer lines, and there seems to be no reason to doubt the practicability of the system. It is a well known and established fact that an alternating current does not cause electrolysis to nearly as great an extent as does direct current. In fact, it is often stated that the alternation of the direction of flow will entirely stop electrolytic action. On this point, however, there seems to be some question. In a thesis presented for a degree at the University of Wisconsin, a report is made of a series of tests to determine the amount of electrolytic corrosion caused by the ordinary 60-cycle alternating current and their findings establish the facts that corrosion is accelerated by an alternating current, though the amount of action is very small compared with direct current electrolysis. It is possible that the increase in corrosion in this case is not due directly to electrolysis, but to the fact that the protecting scale does not form, as I have explained in the case of a direct current entering a pipe and causing increased corrosion. An extended series of tests would be necessary to decide upon the correct solution of this point.

In view of certain court decisions that the railway companies can be compelled to provide that system which is considered best modern practice, it would seem that the interest of gas companies should be enlisted in an endeavor to prove that the new system is the best modern practice, and I am confident that within 10 years it will be regarded as such.

Leaving the consideration of this matter, I wish to take up the question of protection of existing systems from direct current electrolysis. Gas men are apparently almost equally divided into two classes, each of which maintain that electrolysis is best prevented by their general system of protection. Broadly speaking these two classes consist as follows:

1. Of that class which believes in bonding their pipes to the return circuit and cause as much of the current to leave through these bonds as possible.

2. Of that class which aims to make their pipes as poor conductors as possible and thus prevent, as far as possible, all current from entering their pipes.

In addition there are various combinations of the two general systems to be found.

Taking up the first general class it is apparent that, if all current could be collected and kept on the pipe until removed through the bond, it would offer an ideal solution of the problem. The placing of bonds between the pipe and return circuit in the negative area, however, often not only does not help conditions, but makes them much worse. The conductivity of the circuit through the pipe is increased greatly and as a result more current follows the pipe. With cast iron mains we find the greatest trouble caused by current jumping around the joints, and the greater the current flow in the pipe the greater becomes this tendency to jump the joints and, therefore, the greater is the damage to the system. This is especially true where cement joints are employed, and there seems to be hardly a case where bonding would be advisable when these joints are used. Even if the pipe were of uniform conductivity, there would be a tendency for current to follow the pipe through earths of high resistance and leave it again when earths of better conductivity are encountered. In order to make an ideal of this system, it would be necessary to provide pipes whose conductivity would at all times be so much greater than that of the surrounding earth that little current would tend to leave the pipe for other paths. This, however, is a physical impossibility and the system offers at best little relief in the average case.

The other general system has as its ideal fulfillment a pipe that is a non-conductor. It aims to keep all current from following the pipe. From the gas man's standpoint it is the ideal system. When bonding is advocated by gas companies to remove current from their pipes, they partially at least, concede the right of the traction companies to use their pipes as a return circuit. This weakens their position in case they take a claim for damages into the courts. The nearest approach to the ideal system is found in the extensive use of insulating joints to break the continuity of the pipes as return conductors, thus reducing the amount of current carried by the pipes to as small an amount as possible. The proper installation of insulating joints is a very important engineering problem, and one in which every case is a special problem involving quality of earth, moisture, etc., the aim in each case being to allow as little current as possible to jump around the joints. Of recent years the tendency to use wrought iron mains instead of cast iron has been spreading wonderfully. Without involving myself in a question as to tho relative merits of the two, I wish to call attention to the statements of a manufacturer of insulating couplings and patent couplings extensively used for natural gas, to the effect that it is possible to lay wrought iron pipe with an insulating coupling every second joint at a less first cost than for screw pipe of the same size. This point is well worth careful consideration by every gas manager. Considered from the standpoint of reduction in leakage, the shorter life of wrought iron pipe is overcome by the reduction in lost and unaccounted for gas as compared with cast iron pipe.

Electrolysis occurs when a current leaves a conductor through an electrolyte. In our case the pipe must be a conductor and the current leave through earths that are electrolytes. This points out two fundamental methods of curing our troubles: 1. Use pipes that are not conductors. 2. Insulate all pipes from the surrounding earths by a protective covering.

Quite recently there has been announced in France the results of tests with paper gas mains that offer considerable promise. The mains in question were tested under 300 pounds pressure and then subjected to regular service in the ground for some time and were pronounced as good as new when removed for inspection. I am informed that experiments along this line are being started in this country, but cannot secure any information as to the results obtained to date.

Some years ago the use of vitrified pipes was much agitated in this country. Climatic conditions seemed to preclude the possibility of using them in the northern sections. More recently, English patents have been issued on a concrete pipe and system of installation. With the present activity in steel concrete construction, it would seem that there is considerable promise along these lines. The strength of the pipe could easily be designed to at least equal that of cast iron. Several experiments have been tried along this line and I expect to see the matter presented in definite shape for the consideration of gas and water companies within a short time. It would make a report of the greatest importance.

The second essential in the prevention of electrolysis would seem to offer a most interesting field—the invention of a pipe covering that will protect the pipe and prevent current from leaving the pipe through an electrolyte. The prime factor in such a covering is that it must be moisture proof. If moisture proof it would of necessity be gas tight. Leakage could not occur. How much added investment could our companies make per mile of main to prevent leakage alone? Balance interest on investment against the cost of gas lost by leakage and the results will show what an expenditure would be justified from this point of view alone. The subject of coverings for mains and service pipes has been extensively investigated, but so far as I know no one has produced an entirely successful covering. Some recent experiments with a cement covering for pipe has shown that there is a great deal of merit in it if properly applied. Several different tar mixtures, such as the Hickenlooper mixture, are in use for tarring service and small main pipes, and that they are beneficial cannot be denied; but they are not efficient enough. Tarring and boxing service pipes has proven a decided success in some cities, and records show that they greatly increase the life of the service and decrease the leakage. Boxed pipes show very little deterioration from corrosion, and to my mind this process offers the best protection in use at the present time, and there seems to be an increasing popularity for this method of protection. Attempts are being made to devise a covering that can be

moulded on the pipe at a low first cost. Forcing jacks are coming very extensively into use and an extremely strong casing would be required if the pipes were to be forced. Such a covering would have many advantages and would be a very excellent thing.

The whole subject of electrolysis as applied to any case should be studied with one fundamental law in view, namely: "Prevent all current from leaving the pipes through an electrolyte." The nearer we can approach to this condition, the better will conditions become. The interests of the gas fraternity are at present directed largely to the following features of the problem, and future advances toward a solution of the problem may be expected from them. These features are:

1. The introduction of alternating current traction in our cities.
2. The development of a satisfactory protective covering.
3. The development of a new class of electrolysis proof pipe.
4. To industrious application of the fundamental rule to existing systems and conditions.

BIBLIOGRAPHY OF PAPERS AND NOTES ON ELECTROLYSIS APPEARING IN ENGLISH AND AMERICAN JOURNALS, 1901–1905, INCLUSIVE.

By J. M. Humiston—before Western Gas Association—"Electrolysis of Underground Metals." Discusses various methods of protection, viz.: Grounding, 3-wire system for electric railways, compensating feeders, boosters in return, insulating joints, etc. AMERICAN GAS LIGHT JOURNAL, 6-16-02. Page 874.

By A. A. Knudson—Before the American Water Works Association—Describes several cases in detail, giving curves, maps, etc. AMERICAN GAS LIGHT JOURNAL, 7-13-03. Page 47.

Also before American Electro-chemical Society. AMERICAN GAS LIGHT JOURNAL, 5-4-03. Page 691.

Report of Electrolysis Commission of German Society of Gas and Water Engineers. Gives explanation of many instances and specifications for preventing electrolysis. *Journal of Gas Lighting*, 8-16-04. Page 463.

By G. F. Goodnow—Condemns bonding from pipe to rails. The efficiency of a section of glazed pipe. *Journal of Gas Lighting*, 3-31-03. Page 831.

Ohio Gas Light Association Question Box (1904.) Cement coating is discussed; also pitch and tar concrete.

H. E. McGowan—Remedy for electrolytic damage to mains. Boosters in return conductors. *Progressive Age*, 12-15-02. Page 546.

Dr. W. Leybold, of Hamburg, before Gas Section of Engineering Congress at Glasgow, Scotland. Several instances cited. Investigation of pipes swathed in tar and cloth, plain tar and left bare. Discussion of above. *Journal of Gas Lighting*, 9-10-01. Page 630. AMERICAN GAS LIGHT JOURNAL, 9-30-01. Page 527.

Professor F. C. Caldwell—Survey of conditions at Columbus, O., where double trolley is used, show no damage. Recommends return conductors, heavy cement beds for rails, laying of bells in direction of flow, asphalting, etc. *Journal of Gas Lighting*, 6-25-01. Page 1744.

New England Gas Association Question Box. Insulated joints. *Journal of Gas Lighting*, 4-26-04. Page 230.

Capt. Wm. Brady, of Boston. Insulated section of pipe at Wheeling, W. Va. *Journal of Gas Lighting*, 12-23-02. Page 1677.

H. E. Jones—Before the Institute of Civil Engineers, London. Modern Methods of Manufacture and Distribution of Gas. *Progressive Age*, 5-15-02. Page 221.

C. H. Wordingham—Inaugural Address. *Journal of Gas Lighting*, 11-26-01. Page 1374.

Recommendations of Water Commissioners of Middletown, Conn. Double trolley—perfect bonding—returns—and clause in contract making railway company responsible. *Journal of Gas Lighting*, 5-26-03. Page 509.

A. Larson—Experiments of reversing direction of current every 24 hours. *Journal of Gas Lighting*, 12-9-02. Page 1553.

Baltimore Tramway Company to lay heavy copper wire in conduits to collect current. *Journal of Gas Lighting*, 8-26-02. Page 577.

At Manchester, England—Sub-stations are suggested located every mile. *Journal of Gas Lighting*, 5-14-01. Page 1306, from "Electrician."

Editorial on English Relations and Liability for Damage. *Journal of Gas Lighting*, 4-30-01. Pages 1105–1110.

Regulation at Atlantic City, N. J. City Council requires street railways to prevent all damages by electrolysis. *Journal of Gas Lighting*, 2-3-03. Page 300, from *Engineering Record*.

Suit for Damages. *Journal of Gas Lighting*, 1-27-03. Page 203-229.

Estimating depreciation by electrolysis at Richmond, Va. *Progressive Age*, 11-16-03. Page 537.

A Court decision. *Progressive Age*, 5-1-02. Page 178.

Instances:	AMERICAN GAS LIGHT JOURNAL,	3-17-02.	Page 377.
	Journal of Gas Lighting,	5- 5-03.	" 302.
	" " "	5-19-03.	" 428. 461.
	" " "	6- 9-03.	" 683.
	" " "	6 16-03.	" 823.
	" " "	10-13-03.	" 112.
	" " "	11-22-04.	" 617.

Discussion.

The President—You have heard the presentation of Mr. Bump's paper. It is now open for discussion, and I will ask Mr. Von Maur to open the discussion.

Mr. Von Maur—Mr. President and Gentlemen, the subject of electrolysis is certainly gaining in importance to gas men in direct ratio as the destruction of gas mains and services increases, and the cost of repairs is beginning to be appreciated by the gas companies. We may not all know just what electrolysis is, but we certainly know what electrolysis does. A great deal has been written regarding the destruction of gas mains, while very little has been written regarding the destruction of gas services. I can only speak of the experience of the St. Louis gas companies. During the past 3 years we have been forced to renew an enormous number of service pipes, owing to their destruction from electrolysis, whereas, we have had comparatively few cases where the electrolytic action had reached such a stage as to cause a leak or to call our attention to the fact that the main needed renewing. In the few cases where it was necessary to renew the main, we found that the damage was of a local character. It may be true that the mains are suffering materially from electrolysis, without our knowing it, but the point I wish to emphasize is that the damage to our service pipe is so great as to completely overshadow the damage to the gas main. I think we will all agree with Mr. Bump that there have been but two methods seriously proposed to mitigate the effects of electrolysis, namely, one to bond the gas mains to the street railway companies' return circuit, and the other, to make every attempt to insulate the gas pipe system so as to keep the current from reaching the gas mains and services at all. If we turn to the electrical experts for advice, we will find that the same electrical experts hold almost entirely different opinions to-day than they held three years ago. Mr. Bump suggests that we may look for a remedy in the future, when the street car companies decide to adopt the alternating system in the operation of street railways, but even on this subject there is a difference of opinion. For instance, we find in an article written by Mr. H. W. Spang, of New York, the following:

"It is now claimed that the alternating current will not cause electrolytic action in connection with the underground metal pipes, etc. I maintain that such a current will disintegrate such pipes in a manner similar to the disintegration of the carbons in an electric arc lamp operated by such current, and instead of one end of each underground pipe section being pitted as at present by the direct current, both ends thereof will be damaged. The sooner the destructive action of the alternating as well as that of the direct power current is recognized, the more quickly will the general underground electric destruction be prevented."

I doubt whether any of us is willing to put off the remedy until the street railway companies make an entire change in their system of operation. Regarding the relative merits of bonding the systems together, or insulating them, the writer believes that both have considerable merit, and that it is simply a question of adopting the system which is best fitted for the particular problem in hand. In speaking of the city of St. Louis, however, I believe that a great mistake would be made if the gas distribution system was bonded or connected in any manner to the street railway electric circuits. Aside from the legal questions involved, the 800 miles of gas mains intersected practically at every street corner, and from which radiate thousands of services, which are in turn connected back to the water pipes by means of the hot water heaters which are being constantly installed, and finally the water pipes already bonded to the street railway systems, make the problem so complicated that I doubt whether a solution by bonding is possible. However, if the street railway companies are willing to give a good and sufficient bond to pay for all damage due to electrolysis after the bonding is done, then the writer can see no good reason why the gas companies should object, but even if the system were in operation, it would take everlasting vigilance to watch the changing conditions. During the past month, while overhauling a 6-inch cast iron main on Park avenue, we discovered that the gas mains and street railway were bonded together with very heavy copper wire. The pipe on each side of this bond was very badly corroded from electrolysis. A piece of the pipe is herewith submitted. You will note that it is practically destroyed, the iron having disappeared, leaving carbon behind, which, as you see, can be easily cut with a knife. This piece of pipe was taken out 50 feet away from the bond. The location is about 6 blocks from the power house. Last year on Virginia avenue we found exactly a similar condition. These are the only two cases of bonding in St. Louis which I have personally inspected, They would indicate that even though a bond was run from the main to the rail; yet the danger of electrolysis is certainly not removed in the immediate

vicinity of the bond. In 1903, Mr. E. E. Brownell made a survey for the Laclede Gas Light Company. During the past year a re-survey was made by Mr. Schlosser of our Electrical Department, and he found that pipes which in 1903 were negative to the rail, were, 18 months later, positive to the rail, and on the Pintsch pipe lines he found that pipes which were negative to the rail in the fall of 1904 are positive to the rail at the present time. Should a power house be changed, the whole electrical situation would probably be changed with it, and a sub-station would practically have the same effect. Bonds placed to remedy one section of pipe might do so probably at the expense of some other section of pipe located in some different part of the city. It is well known that electric currents are very apt to follow damp soils, and owing to the fact that the condition of the soil as to dampness is not the same during any two consecutive seasons of the year, the original data might be inaccurate and lead to false conclusions. The electrical condition of the ground and of the underground structures is not a constant quantity, and complicates the problem enormously. Then again, if the electrical engineers are correct, it is extremely doubtful whether bonding would do us any good anyway. For instance, Mr. E. E. Brownell, an electrical engineer, who claims to have examined one-half of the total gas pipe mileage in the United States, furnishes some excellent data on this subject. I quote from his report dated April 10, 1903, and addressed to the general manager of the Laclede Gas Light Company, of St. Louis, on page 31, the following:

"The 'drainage system' is virtually nothing more than connecting the water mains by large copper cables, to take the accumulated current off the piping lines.

"These metallic connections are usually made in the immediate vicinity of the power house, to prevent the current from passing from them into the earth with injurious results.

"This plan has many grave objections. The amount of current that the pipes will carry after these connections are made will be tremendously increased, covering these localities, which conditions depend wholly upon the electrical efficiency of the track construction, as both piping lines and rails are then parallel return conductors.

"If the current flow along these pipes, after the connections are made, is greatly increased, there will be a tendency to produce electrolytic action at the calked joints, necessarily depending upon the resistance of the calked joints.

"When the gas mains are properly calked this tendency will be greatly reduced and possibly eliminated. Electrical drops around the joints should determine this electrical condition.

"Experience has taught me that the much talked of electrolysis due to the currents jumping around the joints is a very exaggerated electrical condition.

"The greatest objection to the 'Drainage System' is that it will establish positive areas upon the pipes elsewhere with most serious results.

"We will take for proof of this most ridiculous method the Vandeventer line from Park to Shenandoah, as shown in Fig. 16.

"The water mains are metallically connected by this so called 'Drainage System' in the immediate vicinity of the power house at Park and Vandeventer avenues, the water pipes being but .06 volt negative to the rails, etc., after the connections were made. As you proceed south on Vandeventer avenue from the point where the pipes are connected, you will find at Folsom avenue, just one square south, that the pipes are 4.8 volts positive. The water pipes are beginning to lose the influence of these connections already, for at Blaine avenue the voltage has risen to 10.4 volts positive, which is the second square.

"When the third square is reached the pipes are 12 volts positive, and at Henrietta, the fourth square, the pipes are 12.5 volts positive, with a calculated current flow from pipes to rails of 625 amperes.

"Going south further and then down Shenandoah avenue, the pipes continue positive for a mile, for at Shenandoah and Nebraska they are still 6.6 volts positive.

"Beginning back again from where we started at Park and Vandeventer, and going east on Park avenue, we find the pipes lose this influence of connecting them by copper cables, after they have gone about 800 feet east, being 2.2 volts positive at Grand avenue, 4.8 volts positive at Theresa, 4.2 at Louisiana, 4.6 volts at Virginia and 3 volts positive at Cardinal, and continuing positive until California avenue is reached.

"The pipes are connected by the 'Drainage System" on Geyer avenue at Jefferson avenue, thus reducing the electrical pressure to zero. But then go east on Geyer avenue to 18th street, and there will be found one of the most serious electrical conditions in the entire city, the current on Geyer avenue having eaten up everything metallic within its reach.

"My candid opinion of the "Drainage System" is that it is utterly impracticable, and causes an electrical condition in one locality by making a distorted and more serious electrical situation elsewhere."

Again, opposite page 23, he shows a photograph of a gas main which almost illustrates the limit of electrolysis. Under this photograph is the following note:

"Electrolized cast iron gas main taken from Geyer avenue to which line of pipe the 'Drainage System" has always been applied 1,960 feet distant. It shows what an utter folly this remedy is."

This same note and same photograph appear in his report to the Water Commissioner of St. Louis. Surely here is absolute proof, based on actual experiments in the city of St. Louis, to make a man pause before committing himself to the so-called "Drainage System," but if this is not enough, let us call your attention to a pamphlet recently issued by the Central Foundry entitled "Electrolytic Mitigative Merits of Universal Cast Iron Pipe," by E. E. Brownell, B.E.E., dated Feb. 25, 1906. I quote from page 8 as follows:

"Another very important feature is that universal cast iron lines of piping are homogeneous and require no pipe joint bonding, which is absolutely necessary upon calked piping lines when executing successfully any form of mitigation to protect the piping lines from electrolytic depreciation, thereby saving a cost upon improved streets of at least 12 cents per lineal foot of gas main less than that upon calked pipe lines of similar size."

Here, indeed, we are up against a serious proposition. If it is necessary to bond each and every joint of the 800 miles of pipe in St. Louis, we may well hold up our hands in horror at what confronts us, for this one item would cost us, according to Mr. Brownell's figure, 12 cents per lineal foot. But then the situation may not be as bad as Mr. Brownell puts it, for in his report to the Laclede Gas Light Company in 1903, referred to above, he writes on page 32:

"Experience has taught me that the much talked of electrolysis due to the currents jumping around the joints is a very exaggerated electrical condition."

Personally, I am inclined to accept Mr. Brownell's 1903 opinion, for my experience thus far has not shown me that the joints are particularly affected. If you will refer to Fig. 1 in Mr. Brownell's report to the Central Foundry Company you will find a photograph which is intended to show how bad electrolysis can be at the joint, but if you will examine the photograph carefully, you will find that both the spigot end of the pipe and the hub end of the pipe, for a distance as great as the photograph shows, are exceptionally badly pitted. This would indicate to me that the current was not flowing in the pipe at all, or that it had at one time flowed in one direction, and subsequently in the reverse direction. The writer is inclined to believe, however, that the current was flowing away from the pipe on both sides of the joint, and that probably this pipe was located at some point where it was subjected to an exceptionally bad local condition. Before closing on the subject of bonding, I wish to be understood as applying the arguments advanced only to the city of St. Louis and to other large cities similarly situated. It may readily be that in long lines of pipe or in very simple gas distribution systems, it might be and probably would be good policy to bond, provided, as stated before, the railway companies assume the subsequent damage. Even though the bonding was very efficient and the currents were so directed as to follow the lines of pipe back to the power house, would there still not be great danger of the current leaving the services, which would be at the same potential as the pipe, and particularly in wet soil, cause damage to the service pipes, for under any system the current will, of course, follow all paths available to it in direct ratio to the conductivities of such paths. Again, would it not be necessary for the gas company not only to ally itself to the street railway company, but also to the water company and other concerns who have cast iron pipes in the street, for it seems to me impracticable, even if in granting bonding to be a good thing, to handle the gas pipes independently of the other pipes in the ground, as they parallel each other and pass under and over each other at many points, in addition to being connected together wherever hot water heaters are installed, for there would certainly be a current passing from one pipe to the other where there was a difference of potential and the conditions were favorable. I believe we protect ourselves legally to the greatest degree when we refuse to agree that the street railway company have any right to use our gas mains as part of their return circuit. Regarding the second proposition, namely, that everything be done to insulate the gas distribution system from the street railway system, I would say that as far as cast iron mains are concerned, the writer does not know of any system of insulation which will entirely do away with the effects of electrolysis, for the problem here is just as complicated as in the case of bonding. The most promising results, I believe, line in the harmonious co-operation between the gas companies and the street railway companies. Whenever a case of electrolysis is found, the street railway company should immediately be notified, and the latter in turn should examine its bonds and make them as perfect as it is possible to do. I believe in the majority of instances that if properly approached the street railway men will do all in their power in these lines, especially as it is to their interest to do so, as the remedying of defective pipe joints, for instance, is a net gain to them. The writer does not mean that we should be satisfied with co-operation only to this extent, but feel that the working together and the bringing to notice the damaging effects to the gas companies'

pipes, that such a feeling will be promoted that the street railway company will eventually see the whole question in its proper light, and either take such steps as lie in their power to remedy the evil entirely, or else assume liability for the damage inflicted. On long wrought iron mains which are ordinarily used for distribution of gas at high pressure, the writer feels that our experience about St. Louis is yet too limited to give any decided opinion. We laid these high pressure mains with Dresser insulated couplings placed about every 300 feet. Where the line passes under a railway track we place insulated joints at each joint for three lengths of pipe on each side of the track, and take one length of pipe on each side of the track and lay it in a box of pitch. Within the past few days our Electrical Engineer, Mr. Schlosser, made a partial survey of our 6-inch high pressure line which parallels a street railway track, and he reports that while he found a difference of potential varying from 1.2 volts positive to 1.2 volts negative, yet where the pipe was uncovered there was no evidence of electrolytic action whatever, and the current varied from 0 to 15 amperes. He examined one insulated joint where he expected to find the worst conditions existing, but reports that both sides of the insulated joint showed absolutely no trace of electrolysis. These pipes have been in the ground for only one year. Referring to the source of great damage as mentioned before, namely, the destruction of gas services, I believe that a remedy will be found which will probably consist of some form of insulating joint at the point where the service joins the main, together with covering the service pipe with some form of insulating coating. Mr. Brownell in his report to the Laclede Gas Light Company in 1903 states on page 34:

"Upon wrought iron mains, with screw or riveted construction, these insulated joints might be of great advantage, since the resistance of this class of construction is usually very low, providing that a sufficient number of insulated joints be installed."

In his remarks before the American Gas Light Association meeting, held in Milwaukee, last year, he quoted from his report made to the Director of Public Works, Pittsburgh, Pa., as follows:

"Any manufacturer, contractor or consulting engineer who sells, installs, or recommends insulated pipe joints with the claim that they will eliminate electrical corrosion upon pipe line, does so either with the sole purpose of defrauding the purchaser, or through sheer ignorance, which is still worse."

I wish to assure this convention that in recommending that an insulated joint of some kind be placed at the main where the service joins it, I do not feel guilty of any of the above charges. I feel that in view of the fact that prominent electrical engineers have at least at one time recommended systems which they now oppose, they should be charitable to others who are even more interested in these problems than they are, when it comes to their recommendations. I do not claim that the insulated joint is a good thing for all cases, but I do sincerely feel that the above suggestion of insulating the service has much promise, as evidenced by our experience in St. Louis. I had the Dresser Company make 6 joints, which practically consist of a street ell in combination with an insulated joint, without the use of any screw pipe between the joint and the main. We are installing these joints for experimental purposes in places where we have experienced the most aggravated forms of electrolysis. In one case near the corner of Park and Compton avenues we found the service eaten out by electrolysis on Dec. 22, 1903. It was again destroyed on Oct. 28, 1904, and again on March 22, 1905, and finally on Oct. 11, 1905. We have a 24-inch main at this point, and found that the earth on one side of the main was negative to the rail and on the other side positive to the rail, the current evidently passing to the main on one side and leaving it at the other side. We installed this Dresser insulating ell and put in the service with coated pipe. Our electrical engineer took measurements after the work was done, and gave as his opinion that we would never again have trouble with this service. On another street we had services attacked by electrolysis, of which the following is a sample: 7-14-03 eaten out; 9-21-03 eaten out; 2-1-04 eaten out by electrolysis, fittings and all; 2-1-04 relaid, using perranite pipe; 5-11-04 examined and found O.K., but covering loosened; 6-3-04 found service practically eaten out from main to curb, relaid in box of pitch; 9-27-04 found service in good condition where properly covered, but street ell and tee, together with plug, badly eaten. The stop box from the curb cock was almost entirely destroyed for about 12 inches from the bottom. The curb cock was apparently not affected; service relaid with mixture of pitch tar and sulphur; 11-14-04 service leaking. A hole found in bottom of pipe between electric conduit and curb cock, about ¼-inch in diameter, stop box badly eaten; stop cock corroded with green verdigris, which could be shaved off in the shape of powder with a penknife. Service renewed using more care, 11-4-04; 1-7-05 examined and found O.K., 3-2-05 examined and found O.K., 5-18-05 badly eaten out by electrolysis; service relaid, using Nicholls' coated pipe, and a Dresser coupling placed 18 inches from the main, the whole service was then boxed in pitch. This service has now been in over a year, and has given us no trouble. I might also state that a number of other services on this same street have been treated in the same manner, and have given us no trouble since. Practically every gas man has his own hobby regarding what services or insulating coverings should consist of. While working on this problem, Mr. C. J. Nicholls, Superintendent of our South Division, mentioned the fact that a great many years ago in Chicago he had used a coating consisting of paper and pitch. We took up the matter and first tried two coatings of pitch and two coverings of paper, but this proved inefficient. We then covered the pipe as follows: First, steam is turned into the pipe and the pipe tested, then cleaned and pitch applied with a brush and well rubbed on the pipe, then the paper is wound on spirally, then a second coat of pitch is applied, followed by a second coating of paper, then a third coating of pitch, and finally a third coating of paper. We expect that the last coating of paper will eventually disintegrate, especially in wet soil, but it is applied in order to facilitate handling, and also to make any defect in the coating prominent, as the damaged paper will readily draw the attention of the foreman. In the spring of 1905, our Mr. Schlosser made a test of these pipe coverings by placing a number of different samples in a bath of water, to which was added sal-ammoniac. The neccessary facilities were made to apply a 7-volt current to the coating. The test was begun on February 22d, and the current turned on until February 27th. From this date to March 15th, the pipes were allowed to stand in the water, without any current being turned on. On March 15th the current was again turned on the pipe at an average of 7 volts and continued until March 25th. The pipe with 3 layers of paper and 3 layers of pitch then showed that current was passing through the covering at the rate of .0007 of an ampere, and the report states that the pipe showed no effects from electrolysis; whereas, a piece of uncoated pipe was pitted all over in 5 days' time and was almost eaten in two at the end of the test. A later test made with some slight changes corroborated the above. We now have several thousand of these services in use and up to this time but two of them have failed. In the two cases that failed, it was plainly evident that the foreman had not used the proper care in the installation of the service, and right here is where we find our greatest difficulty. Before we can hope for any success, the drivers handling this pipe from the wagons, as well as service foremen, must use a reasonable amount of care. I believe that many good coatings have been put aside, simply because they were not handled in the manner that the maker intended. While the above coating may not prove to be entirely satisfactory, yet I believe that we are on the right track. Mr. Louis H. Barker, Consulting Engineer, New York, in a paper read before the American Society for testing materials at Atlantic City, stated that after 11 years of tests he found that there was not a single protective covering that he had examined which would stand the tests for a single year. These tests I failed to mention were to protect against the action of the sulphurous gases from the locomotives on steel work and bridges. I quote from his paper:

"In examination of the test bars from time to time it was seen that upon many of them the paint was intact, but with protruding points, which upon being pricked were found to be small rust formations pushing up the paint from behind, clearly indicating that it was not the failure of the paints but the rust action on the inner surface that caused the damage. As no rust can form without the presence of moisture, and as all paints are pervious to moisture (as Dr. Dudley's careful investigations of the subject have proved), this led to the conclusion that it would be necessary in some way to tightly seal the surface. Many kinds of materials for doing this were tried, but with as many different results, until three years ago it was decided that a cheap paraffin paper answered the purpose best of all and since that time all experimentation has been along that line. The few test bars that have b en brought along and exhibited indicate the results. Besides the experimental bars referred to, the paper covering has been tried in a small practical way against smoke action, and after two years and three months exposure an examination of very recent date shows the outer paint, the paper and the first or adhesive coat all intact and in many places where paper was removed for examination the adhesive coat not yet dry and the surface of steel the same as when painted.

"With such satifactory results from this paper process in the smoke tests, it was concluded to make a large scale application and severe test on a large number of I-beams supporting a floor over and within a few feet of salt water, and upon which the rust was due not to smoke but to the almost continuous dampness and presence of sewer gases. This was done over a year ago and up to this time indication of damage of no kind is apparent. The mode of applicalion of the paper is as follows: After the rust is carefully cleaned off by means of stiff wire brushes, a certain kind of tacky paint is applied, the payer then covered

over and tightly pressed upon the painted surface, the joints of the paper slightly lapping. As soon as the paper is in place, it is ready for the outside coat of paint. It will be observed by this process, the first coat of paint, the paper and the coat of paint over the paper can be applied with one scaffolding, thereby greatly reducing the cost, especially in high and dangerous places.

"These experiments, extending over only 3 years, are of too short a duration to determine the value of paper as a protection for iron and steel, but they certainly bring out the fact, at least in the case of smoke and gases, that the action begins from behind the paint and not from in front by the disintegration of the paint."

Absolute results as to the efficiency of this paper covering, as applied to service pipes, will not be available until such pipes and covering have been tested for a period of several years. In addition to the above experiments, the Laclede Gas Light Company is endeavoring to determine the efficiency of wrought iron pipe as compared with steel pipe. The writer feels very strongly that strictly first-class wrought iron pipe will resist the corrosive action to which gas services are subjected, far better than steel pipes. It has been quite noticeable in St. Louis that on streets where the larger size pipes have been eaten out in a very short space of time, the old ¾-inch pipe which has been in the ground for over 30 years, is in many cases practically untouched. We have one experiment consisting of a battery of wrought iron pipes and steel-iron pipes, both coated and uncoated, and insulated and uninsulated with Dressler couplings. This batch of pipes is put in on Geyer avenue, and it will be interesting to note which pipe is first eaten out. I believe that this subject of wrought iron pipe versus steel pipe has not received the attention it deserves, and it is hoped that those best informed on this subject will contribute something to the discussion along these lines.

The President—Mr. McAdam.

Mr. McAdam—In Milwaukee we don't seem to be as unfortunate as some. We have not yet had to contend with such conditions as have appeared at other places, where you can find a hole in a line of main large enough to crawl into, nor can we stick pins or drive nails at will into our mains, as has been shown from time to time, and illustrated as being done by some of the more unfortunate. Still we are not without our troubles. Several years ago we had occasion to replace a 4-inch with a 12-inch, and discovered that a hole could be drilled into some parts of that 4-inch with a pocket knife. This line was on a street 400 feet from the car line and running parallel with it. On examining the 10-inch line near the car tracks, we found no such conditions. This would show that the trouble does not all exist on car lines, but that pipes in the immediate vicinity are also affected. While we consider ourselves fortunate as to our mains, our services, where not protected, are in a deplorable state, and this at points where our mains are not visibly affected. During the last fo ur years we have been placing all services laid under car tracks in pitch; on examining same last fall found them in perfect condition. This is, I believe, the true solution to protection from electrolysis, and is not expensive. In Milwaukee the so-called negative area changes as the location of power houses and substations are changed, where the voltmeter showed high readings between rail and pipe 3 years ago, last year showed extremely low readings, but still the destruction goes on as the examinations of our services have shown. The time is now ripe for someone to devise some practical and, if possible, an economical plan for the protection of our mains, not only on the car lines, but all pipe lines adjoining same. Gas engineers differ as to the best method of doing so, also regarding the use of cement joints, insulated joints, and the class of pipe to use. Some electrical experts give conflicting opinions on same. Some of the best opinions that we have to-day are still at sea regarding the subject, as the following will show: Mr. Brownell in his report to the Milwaukee Gas Light Company of a survey made by him in the fall of 1905 says: The new 6-inch universal pipe in West Allis will succumb to the acute electrolytical condition within a few years, due to the thin or limited thickness of the shell, since such pipe line construction can withstand a less amount of electrolytic loss of metal per given surface or area affected by electrolysis. In his publication this year called "Electrolytic Mitigative Merits of Universal Cast Iron Pipe," he says, on page 7: "Therefore, universal pipe line construction has a uniform electrical continuity, which will eliminate electrolysis at all of the pipe joints, and at the same time offer a comparatively easy solution for mitigating or eradicating eletrolytic action from the entire piping system at a reasonable cost. The electrical conductivity of the class of iron used in Universal pipe is remarkably high, being about 40 per cent. better than the metal used in the average bell and spigot cast iron mains, which ratio is about 52 to 1 in favor of copper, while the lowest conductance found in the Universal pipe is about 36 to 1 compared with copper. It is self-evident, however, that the grain of the Universal cast iron pipe is much closer to the intermolecular constituents of the cast iron and non-metallic ingredients thoroughly and very uniformly combined, which is not generally the case in cast iron of bell and spigot manufacture." And on page 8 he says: "The even grain of cast iron used for Universal pipes also diminishes electrolytic action in a measure, and greatly decreases natural earth corrosiveness and galvanic action." The question now is, which of these statements must we accept as right. I disagree with those who contend that to make our mains as perfect conductors as possible is a good plan, and believe with others that the proper plan is to prevent as far as possible all current from reaching our mains, and when it does so to get rid of it as soon as possible. How are we going to do it under existing conditions? Fault has been found with the cement joint because it causes the current to jump. Must not the same fault be found with the insulated joint or coupling, as it will also force the current to jump? My experience with services laid in pitch has demonstrated the fact that it is a sure cure, but to protect the mains in such a manner is from the point of cost out of the question, therefore I suggest a substitute. Go on using cement joints if you will, but build a box about 12 inches long on the joint and fill it with pitch; 2 inches of pitch will be sufficient around the joint. Do the same in the middle of each length. Let the current jump all it wants to, and should the ground be a reasonable conductor the current stands a good chance of being carried the 5 feet intervening between the pitch insulators. This may appear to some as being a crude method, but do it, and pitch all your services, and I am confident your troubles will be considerably lessened.

The President—Mr. Brownell.

Mr. Brownell—Mr. Chairman and Fellow Members of the Western Gas Association: I feel it below my dignity to refer to personality; but any quotation which I have said, anything which I have written, stands for what it is worth, and it is worth all that it has said. The false construction put upon any literature in which my name has been mentioned is not only discourteous, but it shows the manner in which men deal with things of which they are ignorant. I am not using personality, gentlemen, at all. The subject is so extensive that it would require hours to explain the true principles. One thing may work under certain conditions, and under adverse conditions not work at all. We will begin first with the insulated joint. I stand on record as saying that the man who installs insulated joints with the sole purpose of eliminating electric corrosion, I don't care who he is, is defrauding the man to whom he sells it for that purpose, even though that man may unintentionally sell it. If the piping line travels in the line in which the earth currents are travelling you may have serious electrolytic action along the pipe line. If the pipe line is at right angles to the direction of the current flow through the earth, then your insulating joints will break up the current flow along that piping line and reduce it to zero, no question about that; but as the small per cent. of current flow passing along the pipe line is but a small attribute to the general destruction, therefore it cuts a very small figure. When it comes to the drainage system, my proper conception of the drainage system, which I wish to be known as stating, is this: Extending from the power house in the immediate vicinity of the power house copper cables and connecting them to the pipes in an effort to drain the current from them. You know, or you take it for granted at least, which most of these papers have done, that circumscribing the power house is the electrical peak at the power house. When you reduce that peak by the drainage system you turn it upside down, and you have a crater circumscribing the power house. That is the effect of the drainage system. Extending from the power house to different points of this crater, is the rim of the crater or the basin. You can never return the current with reasonable protection to the pipe line. Now, the Return Feeder System," which I bring out, and which I have generally installed at an expense of possibly $200,000 or $300,000, is not the drainage system, but is the drainage system applied in general all over the whole gas system, and not specifically at one place. The pipe that Mr. Von Maur calls attention to, in which the joint was eaten up, was taken up in Indianapolis. The current can jump around a joint at the same time that other currents can pass from the pipe to the rail. You might have a thousand different paths, shunt on shunt, and a shunt to that, and a shunt to that, until finally you would have a million shunts, and still each proportional amount of current that one would take would be proportional to the relative conductivity of each shunt. The subject is so large, gentlemen, that I am very sorry that I am unable to go into it extensively, but I must say this to the members of the Western Gas Association, that I am under obligation to everyone in this house to seemingly set myself right, and if I do not do so then you can put me down as a rascal and that I draw a salary to which I am not entitled and of which

I rob the gas people to-day. We have a commission to-day appointed on the telephone business, the electric light business and the gas business. We are all working in perfect harmony. The greatest engineers in the world, of which I happen to be one, all agree to the fundamental principles. The cost of mitigating the corrosion is where we run up against a bad proposition, in the conditions which we find. We all know the conditions, and the electrical men admit those conditions are such and such and the result is so and so. But to get back, I want to go on record for this one statement, gentlemen, and I wish every man would take it and apply it locally. The alternating current with 20 cycles produces only 4½ per cent. the amount of the deterioration that direct current will do under the same current density, but with alternating current you cannot reduce any condition by any local application, therefore, you have that 4½ per cent., comparatively to the direct current, that you can never remove, and there is no way of controlling it. I propose, as representing a few of the good gas people, to fight the alternating current from start to finish, because there is no way of mitigating it. With direct current, I will take any reasonable man to some of the largest plants, where I have protected 250 and 300 miles of a pipe line, and if he will show to me that there is one pipe positive to earth. which is the dangerous condition, or a joint, or a drop over any joint, which exceeds 10 milli-volts, then I will step down and out. In conclusion, gentlemen, let me say one thing. Beware of placing false constructions upon clean statments. I would not stand before this Association for one moment and attempt to describe any gas apparatus or anything incidental to it, because I know nothing about it, absolutely nothiug; but I do know the care and preservation, and the rate of deterioration, and the only methods and all the methods incidental to the care and preservation of the pipe and lines, and I have done this myself. It is not my glory that I should say such a thing; in fact, it is only that men force me to do it; they say, "It is up to you to do it, now you do it." It is only the combination of all the forces working together. Moneyed men principally are forcing this issue. They feel that if we can get 90 and 95 per cent. of elimination by cooperation we must do it. And the courts will compel you all to do the same thing, there is no question in the world about it. If you can use your neighbor's property at your expense to remove a menacing condition, which hazards him and hazards you, he can force you to do it. That is the legal advice which I have, as given from the highest source. But now, gentlemen, I hope that you will remove from any statements which I have made any personality connected with them. I feel keenly that the whole paper, backed by Mr. Von Maur, has been putting false statements upon clean, clear, legitimate facts, and I think it is below my dignity to retaliate in any respect to anything contained in that paper. I beg your pardon for such statements, but they stand with my signature to them, and I am ready to back them up at any time. I thank you. (Applause.)

The President—The discussion is on Mr. Bump's paper, gentlemen. Is there any further discussion?

Mr. Elbert—I understood Mr. Von Maur to say that the ¾-inch service in use in St. Louis, the old services, were not affected by the trolley system. I would like to ask him whether those were wrought iron services, which I suppose they were as they were laid years ago. And I would like to ask also, in covering his pipes with paper, what kind of paper he is using, and whether good tar paper would do as well as plain paper.

The President—Is there any further discussion on Mr. Bump's paper? If not, I will ask Mr. Von Maur to answer Mr. Elbert's question.

Mr. Von Maur—Regarding the ¾-inch services, I stated that we found a very large number of them in very good condition alongside of 1¼-inch services which were very badly eaten out. The ¾-inch services were in for probably 30 years. We will assume that they were wrought iron. The 1¼-inch pipes were in only 5 years and are known to be steel pipes. As to the kind of paper we use to cover our pipes, would say that at present we are using plain yellow paper, but I understand that others have used tar paper and had very good results from it.

The President—If there is no further discussion I will extend the thanks of the Association to Mr. Bump for his contribution to our proceedings.

(To be Continued.)

The President of the Macon (Ga.) Gas Light and Water Company announces that the Company has decided to reduce Macon's gas rate rom $1.50 per 1,000 to $1.35, giving a 10 per cent. reduction from the $1.35 for all who pay their gas bills before a certain date each month.

SPECIAL ENGLISH CORRESPONDENCE.

Communicated by Norton H. Humphrys.

Salisbury, England, June 11th, 1906.

Association, or Amalgamation, for Small Gas Undertakings.—The Institution of Gas Engineers.

The question of individual management *versus* combination with central control of small gas undertakings is a matter that for the moment is looming largely before the public eye, attention having been directed thereto by the operations of financiers who deal in that lucrative branch of business known as company promoting. There can be no harm done to the gas industry in general, and to certain prominent undertakings in particular, by the publication of statistics, official or otherwise, showing the increase in consumption of gas, the reductions in price, or the rates of dividend paid. But any unwary investor who is led away by the idea that because a metropolitan gas company selling at 2s. per 1,000 cubic feet can show full dividends and a steady annual increase in consumption, similar satisfactory results can be obtained by the Sloppington-in-the-Slush District Gas Light and Coke Company, the said district covering a number of small villages of 200 to 2,000 inhabitants each, and boasting no staple industry beyond turnip growing, is likely to find out his mistake at a very early date. It is an established fact that a number of electric supply undertakings can be worked from one central office, but the supply of electricity is a simple and less detailed business than the running of a gas undertaking. In the first instance the operations are to a large extent plain routine and can be left in the charge of a very moderately trained manager. But a gas works cannot be successfully run except under the continual supervision of a competent and responsible chief, who is on the works every day and knows every inch of the ground. If a works is large enough to be worth considering as a dividend earning enterprise, it is worth placing under competent management, which must be continuous and not administered in the form of weekly or fortnightly visitations. The cost of management offers no margin for economy. Certainly the directors' fees can be saved, but as a rule the directors of a small concern do not receive princely fees, for the very good reason that there would be nothing left for the shareholders if they did. And the central office would invite travelling and other incidental expenses. The combined company could exercise greater skill in buying and could retain a permanent canvasser and cookery demonstrator. A marked economy might be effected in some instances by shutting down small isolated works and supplying through steel tubes at high pressure from an adjacent township. And unless some sweeping advantage of this sort can be shown, it would appear that nearly all the benefits of amalgamation could be secured by association. Take the case of the companies having respectively capitals of £2,000, £3,000 and £4,000. If these were simply combined under a capital of £9,000, no increase in profit earning capacity would be necessary, and any economy in management might go towards reducing the price of gas and the strengthening and improving the stability of the concern. But the ways of the company promoter are more in the direction of joining up these three concerns under a combination having a capital of £25,000. Under such circumstances, the rate of dividend remaining the same, the profits must be nearly trebled. And it is difficult to see where the additional profit is to come from. The shareholders in the old concerns have, perhaps, received 5 per cent. dividend and the total sales may be 10 millions a year. This means £450, or £45 a million. The shareholders in the new concern will expect at least £5 per cent., and this would mean £1,250 or £125 per million. Systematic canvasses of the supply of fittings and appliances on favorable terms may, perhaps, nearly double the output, but at the same time increase the capital outlay. And a high consumption *per capita* cannot be secured in country districts on any terms if the price is high. Rates of wage, tradesmens' profits and incomes generally are low and cash is scarce, so that the only ones who can do a good trade in country places are those who can sell cheaply. But if the advantages of amalgamation are more than outset by the increased requirements for dividends, where is the prospect of cheaper gas? The amalgamation may be a benefit to somebody, but not to the consumers or to the shareholders. Company mongering operations do not move in the lines of cheap gas nor toward high dividends. Unless a sop is thrown to the consumers in the form of a substantial reduction of price, thus justifying the amalgamation from his point of view, the combined undertaking is likely to be troubled with internal jealousies as between one township and another. The consumers at the more important places will be likely to get the impression that the price of gas is kept

up in their case in order to compensate for losses or lesser profit on the outlying and scanty parts of the district. At any rate, an increase in the price will be out of the question. In some instances large sums of money are expended or proposed to be expended in obtaining parliamentary powers. There is room for an exact understanding as to the meaning of a government franchise. It is to some extent a guarantee of the soundness of the concern, seeing that it is not granted until a departmental committee have been assured of the genuine character of the scheme. But beyond that it carries no security for the investment. The money invested in a statutory concern is not lifted out of the ordinary risks and exigencies of a trading company on to the safe ground of consols or other funds guaranteed by the government. The value of a special act to a district like that of Sloppington-in-the-Slush, aforesaid, is little beyond the fact that it puts a fictitious value on the capital. The Shares of the "Sloppington, etc., Gas Company, incorporated by Act of Parliament," will fetch appreciably more money in the open market than those of the "Sloppington, etc., Gas Company, Limited." But while a franchise granting exclusive powers of supply and other privileges is useful in a district sufficiently wealthy to attract competition, who ever heard of a gas company being injured in that manner in a place like Sloppington? No outsiders would look at it, and the probability is that but for the enterprise of one or two moneyed landowners or other persons interested in the district, and who are, therefore, willing to find the capital at a bare 4 or 5 per cent. interest, there would be no gas supply at all. In sparse country districts the utmost care and economy must be exercised to get any dividend at all, and investors should clearly understand the prospects and position of business at Sloppington are very different to those in a large town, and that the circumstances are so diverse that they can scarcely be combined in the same breath without causing serious misapprehension on the part of those who may not be well informed as to the actual facts.

In connection with this subject it is fortunate that the Council of the Institution of Gas Engineers have been able to secure a paper on "Associated Management of Gas Undertakings" for their next meeting which will be opened in London on the 19th inst., from Mr. R. Bruce Anderson who has had extended practical experience. Whatever Mr. Anderson may recommend, it may safely be anticipated that he will not include the services of the company promoter.

Many if not all of the advantages that are anticipated may be secured by association. I have already alluded to the operations of the Isle of Wight Gas Association, and the commercial section is established as an important feature in connection with more than one district association. I would prefer to see this idea followed out to a larger extent. For one thing it would throw more light on the actual value of the advantages claimed for amalgamation, many of which are more speculative than practical, and I trust that the discussion on Mr. Anderson's paper may be assisted by speakers who have had some experience in the direction of associated work. Until further information is forthcoming I would prefer that every gas works, however small, should retain its individual management. When generator firing was first introduced, thicker side walls and arches were put in than was usual for the smaller old-fashioned settings, and I think it was an American engineer who pointed out that no small share of the advantages could be secured by adopting the new section casings alone, leaving everything as before. In a similar manner many of the advantages of amalgamation can be at once secured by giving the manager the same amount of license in the matter of enterprise, canvassing, etc., that would be accorded to the combined management. I go further than that and claim that a manager who knows his business, knows his customers, and is always on the ground, would lay out new capital to much greater advantage.

The Council of the Institution of Gas Engineers may be congratulated on having issued a programme for the ensuing meeting, in which the consumer does not occupy the lion's share. There are only seven papers, and of these three refer particularly to the carbonization of coal, and one to water gas for small works. They are further to be congratulated on the fact that two of the papers deal specially with small concerns. The tendency of late has been in the direction of Brobdignagian plants, and the importance of cultivating the consumers, both interesting and excellent in their way, but by no means the *ne plus ultra* of gas engineering. We have had enough of slot meters, prepayment schemes, advertising, etc., for a while. There is a refreshing old British Association flavor about the present programme, and I venture to think that the wisdom displayed in its selection will be evidenced by a large attendance and full discussions. Mr. Ernest Körting, of Berlin, is going to deal with the vertical retort from a practical point of view, and his utterances on this topic will be received with great interest, in view of the fact that he is able to bring a large practical experience to bear upon it. Mr. Cotton, of Dublin, will have something to say on the legal relations between road authorities and gas undertakings. At present these depend on a reasonable understanding between the district surveyor and the manager of the gas works. The few clauses that exist in the general gas ads. bearing on the subject are mostly comprised in the Gas Works Clauses Act, 1847, and are not only useless by reason of antiquity, but are clumsily worded in the first place. So that if for any reason an antagonistic feeling exists between the local authority and the gas undertaking, there is room for any amount of misunderstanding and disagreement. It is possible to fall back on highway and other enactments that do not as a rule come within the kin of gas engineers, and there is room for a digest of the whole state of the law, specially making it clear what are and what are not the powers of the local authorities controlling the roads. Some surveyors are apt to look upon the public roads as their exclusive property, and to regard anyone who enters upon them for any reason whatever as a common enemy who deserves to be restricted and penalized in every possible way. The pleasure excursion takes the form of a trip to Boulogne, and includes a 2-hour passage across the English Channel.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE verdict of Coroner Thomas A. Killip in the case of the death of Miss Earnie Oppenheimer, of Rochester, N. Y., is startling in its conclusions. It had been disclosed at the inquest that the death was caused by the imperfect combustion of gas in a water heater, thereby generating carbon monoxide poison. The verdict holds the Rochester Railway and Light Company of that city criminally responsible for her death. For a time the death of Miss Oppenheimer and the serious illness of all members of the family who were present in the house on the evening of May 11 was a mystery that baffled the physicians and the police. Poison of some sort was evident. But not until Dr. Killip instituted a complete investigation and experimented with two dogs, who were killed by the fumes of the same gas heater, was it manifest that the gas was the real cause of the death. The chemical analysis of Professor Latimore confirmed Dr. Killip's diagnosis. The coroner said: "I find that said company did negligently provide, furnish and install said heaters, so improperly constructed, in an improper manner, in that no means were provided for carrying off the waste and other products of combustion therefrom, and said heaters having imperfect combustion of gas burned therein."

THE Seneca Edison Company of Seneca Falls, N. Y.. has made application to the State Commission of Gas and Electricity for permission to consolidate with the Geneva Power and Light Company. It is understood that the Geneva Light and Power Company is under practically the same control as the Inter-Urbane Gas Company which operates here under the name of the Seneca Falls and Waterloo Gas Light Company.

ANNOUNCEMENT was made to-day that the United Gas Improvement Company, of Philadelphia, has secured control of the Dauphin County Gas Company, of Steelton, Pa., with all of its holdings, controlling other companies in Pennsylvania and other States. These comprise companies in Steelton, Oberlin, Middleton, Paxtang, Marysville, Penbrook, Lemoyne, Enola and New Cumberland, fifteen companies between Overbrook and Paoli, near Philadelphia, one near Wilkes-Barre and several in the suburbs of Chicago. The original Dauphin County Gas Company was capitalized at $162,000, and C. H. Geist, of Overbrook, was the president.

CO-OPERATION deals of vast importance to Elmira are about to take place whereby a change of ownership of the Chemung County Gas Company, a reorganization of the Elmira Water, Light and Railroad Company and of the Glen Route management, will take place and will put under one ownership, head and general management all of these concerns. Another deal of equal importance provides for the supply of all power for the proposed Elmira, Corning and Waverly line, of the Glen Route of the local car lines, as well as factory and lighting power for Elmira from the local power station of the Elmira Water, Light and Railroad Company. The proposed reorganization of the local company to include the Glen Route and the Chemung County Gas Company is under way, but not as yet completed. The Chemung County Gas Company is owned by Elmirans. It is the company that furnishes the natural gas to Elmira on an arrangement with the Potter Gas Company.

The Glen Route is virtually owned by the Elmira Water, Light and Railroad Com any though bid in at sheriff's sale by an individual for the company recently. The Elmira Water, Light and Railroad Company is owned jointly by local interests and Bertram, Storrs and Griscom, New York brokers. In reality the reorganization of the local company would have little except legal effect on either it or the Glen Route, but it will make a considerable change in the Chemung County Gas Company, which is now an entirely separate and distinct corporation and competitors in the gas business with the company under whose management it will come. The consummation of this deal will put under one head the management of all of Elmira's surface railroads, including the Glen Route suburban line, all of the natural and artificial gas business for lighting, heating and power, all of the electric power for lighting and power and the water works system.

THE difficulties in the path of the Beloit (Wis) Water, Gas and Electric Company, caused by the defalcation of A. D. Rich, have been removed by Cincinnati and St. Louis capitalists, who have secured a controlling interest in the Beloit merger, and will expend $100,000 in extensions and improvements this summer. With this announcement is another to the effect that Joseph L. Hendley, President, and T. C. Hendley, Secretary-Treasurer of Beloit, will retire from the active management.

AT the meeting of the Street and Sewer Department, the Brandywine Gas and Electric Company made a series of propositions, to be conditions in exchange for a franchise to furnish electric and gas light in Washington, Del. Director John G. Gray was in favor of voting at once to grant the franchise. The other two members, President A. L. Johnson and Director Thomas Melvin, wanted more time to consider the matter and the subject was allowed to go over. Before the discussion was over, Anthony Higgins, counsel for the Delaware Gas and Electric Company, which also has an application for a franchise, came before the board and backed up the promises which had been made by the Brandywine Company. It was intimated that if the Brandywine franchise was granted, the other Company would withdraw its application.

THE E. W. Clark & Co. syndicate, of Philadelphia, has purchased the interests of the Peoria Gas and Electric Company, of Peoria, Ills., and Emil G. Schmidt, now General Manager of the utilities at Springfield, owned by the Eastern syndicate, will take charge of the newly purchased interests.

THE Southern Gas Company seeking a franchise to sell gas at 80 cents at Atlanta, Ga., makes the following petition:

"Petitioners Anton L. Delkin, Frederick E. Ladd and Thomas J. Nestor, submit the following propositions in elaboration of their petition for a franchise to manufacture and distribute gas in this city.

"They and their associates will at once produce a charter under the laws of the State of Georgia, under the name and style of the Southern Gas Company.

"They propose and agree to make an acceptable bond in the sum of $25,000.

"They ask 3 months in which to accept the franchise and execute the bond.

"They agree to begin actual work on the construction of a gas plant within 3 months from the time the franchise is accepted and the bond executed.

"They agree to begin furnishing gas to consumers within 18 months after work on the construction of the plant is begun. They desire the franchise to run at least 30 years.

"They will not object to the requirement that a special permit shall be obtained before work begins in any street, but ask the right, under such special permit, to open all streets, sidewalks and alleys necessary to the establishment of a gas plant for serving the entire city of Atlanta."

MR. F. S. MAYER, Superintendent of the municipal gas plant at Norwich, Conn., has resigned.

THE East Ohio Gas Company will build another 18-inch main from the West Virginia fields to Cleveland, O., but it may not be completed until a year from now, because of inability to secure the wrought iron pipe necessary.

AFTER the appropriation of $75,000 for buying a municipal light and water plant, three expert engineers, chosen by the appraisers, have informed the Mayor of Port Washington, Wis., that the city could buy light and water cheaper of a private corporation than it could furnish them itself.

THE Massachusetts Board of Gas and Electric Light Commissioners announced its finding on the petition of customers of the East Boston Gas Company for a reduction in the price of gas, and recommends that, on and after July 1, the price of gas sold by this Company shall not exceed $1.10 per 1,000 feet, and on and after January 1 next the price shall not exceed $1 per 1,000 feet. The present price is $1.20.

THE Massachusetts Gas Companies declared an initial dividend of 1 per cent. on common at rate of 3 per cent. a year. The dividend is payable August 1. Boston Consolidated Gas Company, regular quarterly of 2 per cent., payable June 30.

CITY SOLICITOR FRANCE, of Woonsocket, R. I., has reported for the special committee on investigating gas conditions that he cannot find any records where the town of Cumberland or the city of Woonsocket granted the Woonsocket Gas Company rights to lay mains. The Legislature years ago granted the Company a charter to do this, with the provision that permission was to be obtained from the town or city.

A MT. CARMEL (Ills.) man has secured a 25-year franchise to put in a gas plant in that city. Gas is to be furnished at $1.10 per 1,000 cubic feet, and when paid promptly at the 1st of the month the 10 cents is to be thrown off.

THE Warren-Pettigrew Company, a Wisconsin corporation, asks for a franchise from the city of Merrill, Wis., to construct a gas plant for the purpose of supplying gas to said city.

BY consent of the city of Sedalia, the suits to forfeit the franchises of the Sedalia Gas and Fuel Company and the Sedalia Electric Light and Power Company, for failure to comply with their contracts with the city, were dismissed in the Johnson county Circuit Court. The companies must pay $2,500 to the city because of poor service rendered the past year, and deposit $10,000 cash as a guarantee that $50,000 will be expended before December 1, 1906, in improving the two properties, which are owned by St. Louis capitalists.

THE Charlottesville (Va.) City Council voted to lease the city gas plant for a period of 20 years to Washington parties. The terms are considered liberal.

BY an overwhelming majority Sibler (Ia.) voted recently to build a gas light plant and issue bonds in payment therefore. The vote was 336 to 33 against. Women to the number of 147 voted nearly unanimously in the affirmative.

J. S. CHICHESTER, of Chicago, Ills., is seeking the gas franchise at Natchez, Miss.

THE number of gas manufacturing establishments in the United States in 1905 was 1,017, an increase over 1900 of 14 per cent.; amount of capital employed, $697,095,928, an increase of 22.9 per cent.; wages paid, $17,045,404, an increase of 37.1 per cent.; cost of materials, $37,147,961, an increase of 80.3 per cent.; value of products, $125,036,955, or 65.1 per cent.; cubic feet manufactured, 116,501,351,642, an increase of 73.6 per cent.

THE joint sub-committee of the Council appointed to look into the matter of securing an engineer to look into the needs and accompanying cost of the Gas Department of Richmond, Va., for rehabilitation, had eight bids, and the bid of Charles H. Evans, of Chicago, being the lowest, was recommended. Evans offers to do the work for $1,500 and fees for supervision. The sub-committee originally recommended the selection of Robert W. Hunt & Co., of New York. This recommendation was turned down by the committee and the matter sent back with instructions to advertise bids. This was done, and the following bids were received and opened last night:

H. T. Duke, Philadelphia, 2 per cent. of the final cost of plant.
W. E. Barrett, Scranton, $2,000, or 3 per cent. of cost if engaged to supervise the work.
L. L. Merrifield, Toronto, no figures.
Baxter & Young, Detroit. $3,800, or 1 per cent.
Fred Enger, Norfolk, $8,500, $300 per month and clerk.
Robert W. Hunt & Co., New York, $2,500 and fees for supervision.
Charles H. Evans, Chicago, $1,500 and fees for supervision.
F. J. Meyer, Baltimore, 7½ per cent. on complete cost.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No 42 Pine Street, New York.
Telephone, 2996 John.

TERMS:

SUBSCRIPTION—Three Dollars per annum, in advance. Single copies, 10 cents.

The JOURNAL is the official organ of the
NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.
AMERICAN GAS LIGHT ASSOCIATION.
WESTERN GAS ASSOCIATION.
OHIO GAS LIGHT ASSOCIATION.

NOTIFICATION RESPECTING ADVERTISING.

Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:

New York—American News Co., 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, JULY 2, 1906.

The Market for Gas Securities.

Final papers in the lease of the Cincinnati Gas and Electric Company to the Union Gas and Electric Company have been signed and the new management will assume control of the local company July 1. In the next five years $2,000,000 will be spent on improvements and it is stated that a new electric plant will be erected. The deal which has just been completed involves about $56,000,000. The guarantee of dividends is secured by a deposit of $3,000,000 by the eastern syndicate and following is the rate of dividends which will be paid: 4½ per cent. until July, 1908; 4¾ per cent. from July, 1908, to July, 1910; 5 per cent. for the remainder period of the 95-year lease. Under the terms of the lease, the city has the privilege to acquire the local property, but if such action takes place, the lessee has the privilege of purchasing the entire capital of the Cincinnati Gas and Electric Compay at $110 per share.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.
16 WALL STREET, NEW YORK CITY.
JULY 2.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $1 00 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	135⅝	139
Central Union, Bonds, 5's	3,000,000	1,000	101	104
Equitable Bonds, 6's	1,000,000	1,000	..	105
" 1st Con. 5's	2,300,000	1 000	118	120
Mutual	3,500,000	100	225	250
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co. ..				
Bonds, 5's	11,000,000	1,000	103	105
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	37	43
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	..	98	104
Northern Union Bonds, 5's.	1,250,000	1,000	101	103
New York and East River..				
Bonds 1st 5's	3,500,000	1,000	108	111
" 1st Con. 5's	1,500,000	..	104	110
Standard	5,000,000	100	140	160
Preferred	5,000,000	100	165	175
Bonds, 1st Mortgage, 5's	1,500,000	1,000	111	114
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	120	130
" " Bonds(5's)	15 000,000	1,000	108	112
Bay State	50,000,000	50	5/16	¾
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	..	65
" 1st Mtg. 5's	509,000	1,000	95	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000.000	1.000	47½	50
Buffalo City Gas Co.	5,500,000	100	9	10
" " Bonds, 5's	5,250,000	1,000	75	80
Capital, Sacramento	500,000	50	..	35
Bonds (5's	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	106¾
Cincinnati Gas and Electric Co.	29,500,000	100	103⅛	103¾
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	90	..
Columbus (O.) Gas Lt. & Heating Co.	1,682,750	100	..	95
Preferred	3,026,500	100	107¾	108
Consumers, Toronto	2,300,000	50	200	204
Consolidated, Baltimore	11,000,000	100	90	..
Mortgage, 6's	3,500,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N. J.	1,000,000	100	15	17
" Con. Mtg. 5's	880,000	1,000	92	95
Bonds	75,000	..	..	100
Detroit City Gas Co	5,000,000	50	..	50
" Prior Lien 5's	4,618,000	1,000	..	98
Detroit Gas Co., 5's	381,000	1,000	75	80
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	..	110	112
" Bonds, 5's	10,500,000	..	107⅛	108⅛
Indianapolis	2,000,000	..	60	70
" Bonds, 5's	2,650,000	..	104½	105
Jackson Gas Co	250,000	50	82	..
" 1st Mtg. 5's	290,000	1,000	97	100
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	..	105
Preferred	2,500,000	100	95	110
Bonds	10,000,000	1,000	104	104¼
Lafayette Gas Co., Ind.	1,000,000	100	..	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	143	145
Madison Gas & Elec. Co. " 1st Mtg. 6's	350,000	1,000	106	108¾
" 6 per cent. scrip, due 1910	100,000	25	85	87
Massachusetts Gas Companies of Boston—				
Common	25,000,000	100	59	59⅛
Preferred	25,000,000	100	87½	88
Montreal, Canada	2,000,000	100	218	218¾
Nashville Gas Lt. Co.	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	6,000,000	..	137	138
New Haven	2,000,000	25	200	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	89	89¾
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	..
Rochester Gas & Elec. Co..	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	104½	105¼
San Francisco, Cal.	15,800,000	100	..	..
St. Joseph Gas Co. 1st Mtg. 5's	751,000	1,000	92	..
St. Paul Gas Light Co	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	118½	115
General Mortgage, 5's	2,465,000	1,000	96¾	..
Syracuse, N. Y.	1,975,000	100	50	55
Bonds	2,047 000	1,000	102	..
Washington, D. C	2,600,000	20	300⅝	301
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	..	..	..
Wilmington, Del	600,000	50	330	..

Advertisers' Index.

GAS ENGINEERS. Page

A. E. Boardman, New York City ... 17
Baxter & Young, Detroit, Mich ... 35
B. E. Chollar, St. Louis, Mo ... 28
Cruse-Kemper Co., Philadelphia, Pa ... 24
David Leavitt Hough, New York City ... 35
Davis & Farnum Mfg. Co., Waltham, Mass ... 36
Economical Gas Apparatus Construc'n Co., Toronto, Ont 17
Frank D. Moses, Trenton, N. J ... 36
Fred. Bredel Co., Milwaukee, Wis ... 34
Frederic Egner, Washington, D. C ... 40
H. M. Byllesby & Co., Chicago, Ills ... 23
Humphreys & Glasgow, New York City ... 37
Isbell-Porter Co., Newark, N J ... 24
J. F. W. Jost, Philadelphia, Pa ... 25
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 36
The Gas Machinery Co., Cleveland, O ... 20
The Jeffrey Manufacturing Co., Columbus, O ... 34
United Gas Improvement Co., Philadelphia, Pa ... 31
Western Gas Construction Co., Fort Wayne, Ind ... 1144

GAS WORKS APPARATUS AND CONSTRUCTION.

A. E. Boardman, New York City ... 17
Bartlett, Hayward & Co., Baltimore, Md ... 37
Baxter & Young, Detroit, Mich ... 35
Connelly Iron Sponge & Governor Co., New York City ... 34
Continental Iron Works, Brooklyn, N. Y ... 38
Cruse-Kemper Co., Philadelphia, Pa ... 24
Davis and Farnum Mfg. Co., Waltham, Mass ... 36
Delly & Fowler, Philadelphia, Pa ... 40
Economical Gas Apparatus Construc'n Co., Toronto, Ont 17
Empire Gas Construction & Improvement Co., N. Y. City. 25
Frank D. Moses, Trenton, N. J ... 36
Fred. Bredel Co., Milwaukee, Wis ... 34
G. Shepard Page's Sons, New York City ... 35
Humphreys & Glasgow, New York City ... 37
Isbell-Porter Company, New York City ... 24
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 36
Lloyd Construction Co., Detroit, Mich ... 26
Logan Iron Works, Brooklyn, N. Y ... 40
Quintard Iron Works, New York City ... 37
R. D. Wood & Co., Philadelphia, Pa ... 38
Riter-Conley Mfg. Co., Pittsburgh, Pa ... 39
Stacey Mfg. Co., Cincinnati, O ... 39
The Gas Machinery Co., Cleveland, O ... 20
The Jeffrey Manufacturing Co., Columbus, O ... 34
United Gas Improvement Co., Philadelphia, Pa ... 31
Western Gas Construction Co., Fort Wayne, Ind ... 1144

PROCESSES.

Bartlett, Hayward & Co., Baltimore, Md ... 37
B. E. Chollar, St. Louis, Mo ... 28
California Light and Fuel Co., San Francisco, Cal ... 38
Economical Gas Apparatus Construc'n Co, Toronto, Ont. 17
Fred. Bredel Co., Milwaukee, Wis ... 34
Humphreys & Glasgow, New York City ... 39
The Gas Machinery Co., Cleveland, O ... 20
United Gas Improvement Co., Philadelphia, Pa ... 31
Western Gas Construction Co., Fort Wayne, Ind ... 1144

SCRUBBERS AND CONDENSERS.

Continental Iron Works, Brooklyn, N. Y ... 38
Cruse-Kemper Co., Philadelphia, Pa ... 24
Davis & Farnum Mfg. Co., Waltham, Mass ... 36
Economical Gas Apparatus Construc'n Co., Toronto, Ont 17
Fred. Bredel Co., Milwaukee, Wis ... 34
Isbell-Porter Co., Newark, N. J ... 24
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 36
Logan Iron Works, Brooklyn, N. Y ... 42
R. D. Wood & Co., Philadelphia, Pa ... 38
Riter-Conley Mfg. Co., Pittsburgh, Pa ... 39
Stacey Mfg. Co., Cincinnati, O ... 39
The Gas Machinery Co., Cleveland, O ... 20
Western Gas Construction Co., Fort Wayne, Ind ... 1144

PRODUCER POWER PLANTS.

Economical Gas Apparatus Construc'n Co., Toronto, Ont. 17
R. D. Wood & Co., Philadelphia, Pa ... 38

TAR AND CARBONIC ACID EXTRACTOR.

Economical Gas Apparatus Construc'n Co., Toronto, Ont. 17
Fred. Bredel Co., Milwaukee, Wis ... 34
Isbell-Porter Co., Newark, N. J ... 24
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 36
Stacey Mfg. Co., Cincinnati, O ... 39
The Gas Machinery Co., Cleveland, O ... 20
Western Gas Construction Co., Fort Wayne, Ind ... 1144

AMMONIA CONCENTRATORS.

Fred. Bredel Co., Milwaukee, Wis ... 34
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 36
Michigan Ammonia Works, Detroit, Mich ... 16
The Gas Machinery Co., Cleveland, O ... 20
Western Gas Construction Co., Fort Wayne, Ind ... 1144

GAS METERS.

American Meter Co., New York and Philadelphia. 43
Detroit Meter Company, Detroit, Mich.....1143
D. McDonald & Co., Albany, N. Y..... 41
Helme & McIlhenny, Philadelphia, Pa..... 43
John J. Griffin & Co., Philadelphia, Pa. 44
Keystone Meter Co., Royersford, Pa..... 42
Maryland Meter and Mfg. Co., Baltimore, Md..... 42
Metric Metal Co., Erie, Pa..... 43
Nathaniel Tufts Meter Co., Boston, Mass..... 42
New York Improved Meter Co., New York City 42
Pittsburgh Meter Co., Pittsburgh, Pa..... 41
Rotary Meter Co., New York City..... 19

PREPAYMENT METERS.

American Meter Co., New York and Philadelphia..... 43
D. McDonald & Co., Albany, N. Y..... 41
Helme & McIlhenny, Philadelphia, Pa..... 43
John J. Griffin & Co., Philadelphia, Pa..... 44
Keystone Meter Co., Royersford, Pa..... 42
Nathaniel Tufts Meter Co., Boston, Mass..... 42
New York Improved Meter Co., New York City..... 42
Pittsburgh Meter Co., Pittsburgh, Pa..... 41

PREPAYMENT METER ATTACHMENTS.

New York Improved Meter Co., New York City 42
Reeves Mfg. Co., New Haven, Conn..... 41

WATER METERS.

Pittsburgh Meter Co., Pittsburgh, Pa..... 41

GAS AND WATER PIPES.

Davis & Farnum Mfg. Co., Waltham, Mass..... 36
Donaldson Iron Co., Emaus, Pa..... 28
Economical Gas Apparatus Construc'n Co., Toronto, Ont. 17
R. D. Wood & Co., Philadelphia, Pa..... 38
Warren Foundry and Machine Co., New York City..... 28

GAS COALS.

Berwind-White Coal Mining Co., New York and Phila. 34
Perkins Co., New York City..... 34
Westmoreland Gas Coal Co., Philadelphia, Pa 35

SPECIALTIES FOR OIL AND PIPE LINES.

S. R. Dresser, Bradford, Pa..... 22

GAS MAIN STOPPERS.

Safety Gas Main Stopper Co., New York City..... 28

MAIN AND SERVICE LAYING.

Sullivan Bros., Flushing, N. Y..... 1122

GAS TAPPING MACHINES.

George Light, Dayton, O..... 28
H. Mueller Manufacturing Co., Decatur, Ills..... 26

CANNEL COALS.

Perkins & Co., New York City..... 34

STOKING MACHINERY.

G. A. Bronder, New York City..... 35

CONVEYORS.

Adam Weber Sons, New York City..... 32
Cruse-Kemper Co., Philadelphia, Pa..... 24
C. W. Hunt Company, New York City..... 27
Dodge Coal Storage Co., New York City 28
Economical Gas Apparatus Construc'n Co., Toronto, Ont 17
Fred. Bredel Co., Milwaukee, Wis..... 34
G. A. Bronder, New York City..... 35
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 36
The Gas Machinery Co., Cleveland, O..... 20
The Jeffrey Manufacturing Co., Columbus, O..... 34
The Link-Belt Engineering Co., Philadelphia, Pa... 27
The Link-Belt Machinery Co., Chicago, Ills 28
Western Gas Construction Co., Fort Wayne, Ind.....1144

CHARGING BARROWS & COAL WAGONS.

Davis & Farnum Mfg. Co., Waltham, Mass..... 36
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 36
Stacey Mfg. Co., Cincinnati, O..... 39

GAS ENRICHERS.

Standard Oil Co., New York City, ... 1135
Sun Company, Pittsburgh, Pa..... 35
The Sun Oil Co., Pittsburgh, Pa..... 35

COKE CRUSHERS.

C. M. Keller, Columbus, Ind..... 35
Fred. Bredel Co., Milwaukee, Wis..... 34
The Jeffrey Manufacturing Co., Columbus, O..... 34

GAS METER CONNECTIONS.

H. Mueller Manufacturing Co., Decatur, Ills..... 26

GAS COCKS.

H. Mueller Manufacturing Co., Decatur, Ills..... 26

GAS GAUGES.

The Bristol Co., Waterbury, Conn..... 20

GAS GOVERNORS.

Connelly Iron Sponge & Governor Co., New York City. 33
Fred. Bredel Co., Milwaukee, Wis. 34
Isbell-Porter Co., Newark, N. J..... 24
Johnson-Reynolds Co., Anderson, Ind..... 35
Pittsburgh Meter Co., Pittsburgh, Pa..... 41
R. D. Wood & Co., Philadelphia, Pa..... 38

CEMENTS.

C. L. Gerould, Pittsburgh, Pa..... 32
F. W. Stanley, New York City..... 32

RETORTS AND FIREBRICKS.

Adam Weber Sons (Albert J. Weber's Construction).. 32
Baltimore Retort and Firebrick Co., Baltimore, Md.. 32
Brooklyn Firebrick Works, Brooklyn, N.Y..... 32
Henry Maurer & Son, New York City..... 32
James Gardner, Jr., Co., Pittsburgh, Pa..... 32
J. H. Gautier & Co., Jersey City, N. J..... 32
Laclede Firebrick Mfg. Co., St. Louis, Mo..... 20
Missouri Firebrick Co., St. Louis, Mo..... 32
National Pyrogranit Co., New York City..... 32
Parker-Russell Mining and Mfg. Co., St. Louis Mo.... 31
St. Louis Gas Construction Co., St. Louis, Mo..... 32

(*Continued on page 17.*)

DIVIDEND NOTICE.

OFFICE OF THE UNITED GAS IMPROVEMENT CO.,
N. W. CORNER BROAD AND ARCH STS.,
PHILADELPHIA, PA., June 13, 1906.

The Directors have this day declared a quarterly dividend of 2 per cent. (one dollar per share), payable July 14th, 1906, to stockholders of record at the close of business, June 30, 1906. Checks will be mailed.

1619-4 LEWIS LILLIE, Treasurer.

NOTICE!

PLEASE read the advertisement of the Empire Gas Improvement and Construction Company, on page 25. This Company employs only high-priced and quick-working mechanics, and all its work is guaranteed to be strictly first class, and will be finished at time specified. A. M. SUTHERLAND,

1545-eot. tf 49 Wall Street.

POSITION WANTED.

Manager.....Superintendent.....Engineer.

Age 29. American. Married. Graduate of Pratt University in mechanical engineering. Has made special study of gas business in all its branches. Can design and superintend construction. Is a skillful operator and excellent superintendent. At present employed. Salary expected, $1,800.

Address, P 6841, HAPGOODS BRAIN BROKERS,
1621-1 PHILADELPHIA, PA.

WANTED, AT ONCE,

Position as Superintendent or Assistant Superintendent of Gas Works.

Eleven years' experience in water and coal gas manufacture. Best of references. Desire to change at once on account of health.

1621-1 Address, "SUPT. A.," care this Journal.

WANTED,

POSITION AS MANAGER,

By gentleman having 20 years' experience in construction and management of gas and other public utilities, speaking English, German and Spanish. References. Address, "F. W. H.,"

1621-1 Care this Journal.

WANTED,

Position as Superintendent of Works,

By practical man having 10 years' experience in the different branches of the gas business, and understanding manufacturing, distribution and construction work thoroughly. Small plant preferred

1620-2 Address, "T. A. B.," care this Journal.

Position Wanted

As Meter Repairer.

First class in every respect, and best of references. Address, "P. E. H.,"

1621-2 Care this Journal.

WANTED,

Gas Works Foreman, at Once.

Coal and water gas. Must be willing to work. Give experience, references and wages expected. Address, "P. L. P.,"

1621-1 Care this Journal.

WANTED,

To Buy in Lots from 50 to 500, Second-hand Lamp Posts.

Address,
NASSAU & SUFFOLK LIGHTING CO.,
1620-2 FREEPORT, N. Y.

Will Buy or Lease Gas Plants

In cities of over 7,000. No commissions charged. GEORGE ALBERT DROVIN,
Attorney-at-Law, 1420 Chestnut St.,
1619-4 PHILADELPHIA, PA.

3-LIGHT TIN METERS FOR SALE.

For sale, 1,000 3-light, second-hand tin meters; tested, painted and in good condition. Price, $3 each, f.o.b. Portland. Address,
1621-4 PORTLAND GAS CO., Portland, Ore.

FOR SALE.

ONE AMMONIA WASHER-SCRUBBER.

Made by Isbell-Porter Company.
Sixteen-inch connections.
Capacity, 800,000 feet per day.
This machine is in first-class condition.

SPRINGFIELD GAS LIGHT CO.,
1620-tf SPRINGFIELD, MASS.

Utilize Your Gas Liquor.

NO EXTRA LABOR OR OPERATING EXPENSES.

IMPROVED AMMONIA CONCENTRATOR.

About 100 in use. Write to
STROH & OSIUS, Patentees, or
MICHIGAN AMMONIA WORKS, - Detroit, Mich.

GREENPOINT

O·X·I·D·E

IS RELIABLE.

We quote "delivered" prices.
May we not send you a sample?

Greenpoint Chemical Works, Brooklyn, N. Y.

Practical Photometry,

By William Joseph Dibdin.

Price, - - - - $3.00.

FOR SALE BY

A. M. CALLENDER & CO.,

42 Pine St., New York City.

Do You Wish to Know

what size of pipe to use to convey any quantity of gas, any distance, with any loss of pressure and any initial or final pressure? Then use

Cox's Gas Flow Computer,

as it gives this information accurately at sight, without mental effort. No calculations needed. Saves time, money and mistakes.

Price, 6.5 x 8 inches, in cloth case, $2.50.
For sale by

A. M. Callender & Co., 42 Pine St., N. Y.

(*Concluded from page* 16.)

INCLINED RETORTS.

Adam Weber Sons (Graham-Morton [England] System) 32
Baltimore Retort and Firebrick Co., Baltimore, Md..... 32
Fred. Bredel Co., Milwaukee, Wis..... 34
Parker-Russell Mining and Mfg Co., St. Louis, Mo..... 33
St. Louis Gas Construction Co., St. Louis, Mo..... 32

VERTICAL S'S.

Adam Weber Sons, New York City..... 32
Connelly Iron Sponge & Gov.Co. (Drake's[Eng.]System) 33
Fred. Bredel Co., Milwaukee, Wis..... 34
Parker-Russell Mining and Mfg. Co., St. Louis, Mo,..... 33
St. Louis Gas Construction Co., St. Louis, Mo..... 32

VERTICAL RETORTS, CHARGING AND DISCHARGING VERTICALLY.

Adam Weber Sons, New York City..... 32

REGENERATIVE FURNACES.

Adam Weber Sons, New York City. 32
Baltimore Retort and Firebrick Co., Baltimore, Md 32
Bartlett, Hayward & Co., Baltimore, Md..... 37
Fred. Bredel Co., Milwaukee, Wis,..... 34
J. H. Gautier & Co., Jersey City, N. J..... 32
Laclede Firebrick Mfg. Co., St. Louis, Mo..... 20
Missouri Firebrick Co., St. Louis, Mo..... 32
Parker-Russell Mining and Mfg. Co., St Louis, Mo..... 33
St. Louis Gas Construction Co., St. Louis, Mo..... 32

SELF-SEALING MOUTHPIECE DOORS.

Continental Iron Works, Brooklyn, N. Y..... 40
Davis & Farnum Mfg. Co., Waltham, Mass..... 36
Fred. Bredel Co., Milwaukee, Wis..... 34
Isbell-Porter Co., Newark, N. J..... 24
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 36
Logan Iron Works, Brooklyn, N. Y..... 40
R. D. Wood & Co., Philadelphia, Pa..... 38
Stacey Mfg. Co., Cincinnati, O 39
The Gas Machinery Co., Cleveland, O..... 20
Western Gas Construction Co., Fort Wayne, Ind.....1144

CHIMNEY CONSTRUCTION.

Adam Weber Sons, New York City..... 32

INCANDESCENT GAS LAMPS.

D. M. Steward Mfg. Co., Chattanooga, Tenn..... 22
General Gas Light Co., Kalamazoo, Mich..... 21
Geo. G. Ramsdell, New York City..... 942
Welsbach Company, Gloucester, N. J..... 30

BURNERS.

D. M. Steward Mfg. Co., Chattanooga, Tenn.. 22
Wm. M. Crane Co., New York City.. 22

LAVA GAS TIPS.

D. M. Steward Mfg. Co., Chattanooga, Tenn..... 22

STREET LAMPS.

Thos. T. W. Miner, New York City..... 28
Welsbach Street Lighting Co., New York and Phila... 30

PURIFIERS.

Connelly Iron Sponge & Governor Co., New York City.. 33
Cruse-Kemper Co., Philadelphia, Pa..... 24
Davis & Farnum Mfg. Co., Waltham, Mass..... 36
Fred. Bredel Co., Milwaukee, Wis..... 34
Isbell-Porter Co., Newark, N. J..... 24
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 36
R. D. Wood & Co., Philadelphia, Pa..... 40
Stacey Mfg. Co., Cincinnati, O.. 39
Western Gas Construction Co., Fort Wayne, Ind. 1144

PURIFYING MATERIALS.

Connelly Iron Sponge & Governor Co., New York City.. 33
Greenpoint Chemical Works, Brooklyn, N. Y..... 16

VALVES.

Continental Iron Works, Brooklyn, N. Y.. 38
Davis & Farnum Mfg. Co., Waltham, Mass..... 36
Economical Gas Apparatus Construc'n Co, Toronto, Ont 17
Isbell-Porter Co., Newark, N. J..... 24
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 36
Ludlow Valve Manufacturing Co., Troy, N. Y..... 25
R. D. Wood & Co., Philadelphia, Pa..... 40
Stacey Mfg. Co., Cincinnati, O..... 39
The P. H. & F. M. Roots Co., Connersville, Ind..... 27
Western Gas Construction Co., Fort Wayne, Ind.....1144

EXHAUSTERS.

Connelly Iron Sponge & Governor Co., New York City.. 33
Connersville Blower Co., Connersville, Ind..... 18
Davis & Farnum Mfg. Co., Waltham, Mass..... 36
Isbell-Porter Company, Newark, N. J..... 24
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 36
The P. H. & F. M. Roots Co., Connersville, Ind..... 27

PURIFIER SCREENS.

John Cabot, Hoboken, N. J..... 20
Western Gas Construction Co., Fort Wayne, Ind..... 1144

GAS STOVES.

American Meter Co., New York and Philadelphia 43
Keystone Meter Co., Royersford, Pa..... 42
Maryland Meter & Manufacturing Co., Baltimore, Md.. 42
Nathaniel Tufts Meter Co., Boston, Mass..... 42

HOT WATER HEATERS.

Humphrey Co., Kalamazoo, Mich..... 23

GASHOLDER TANKS.

J. P. Whittier, Brooklyn, N.Y..... 28

GASHOLDERS.

Bartlett, Hayward & Co., Baltimore, Md..... 37
Continental Iron Works, Brooklyn, N. Y..... 38
Cruse-Kemper Co., Philadelphia, Pa. 24
Davis & Farnum Mfg. Co., Waltham, Mass,..... 36
Deily & Fowler, Philadelphia, Pa.... 40
Economical Gas Apparatus Construc'n Co., Toronto, Ont 17
Kerr Murray Mfg. Co., Fort Wayne, Ind. 36
Logan Iron Works, Brooklyn, N. Y..... 40
R. D Wood & Co., Philadelphia, Pa. 38
Riter Conley Mfg. Co., Pittsburgh, Pa..... 39
Stacey Mfg Co., Cincinnati, O 39
Western Gas Construction Co., Fort Wayne, Ind.....1144

STORAGE TANKS.

Davis & Farnum Mfg. Co., Waltham, Mass..... 36
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 36
Stacey Mfg. Co., Cincinnati, O..... 39
Western Gas Construction Co.. Fort Wayne, Ind..... 1144

PAINTS.

American Standard Composition Co., New York City.. 23

PATENTS, TRADE-MARKS, COPYRIGHTS.

Royal E. Burnham, Washington, D. C. 20

THE ECONOMICAL GAS APPARATUS CONSTRUCTION COMPANY, LIMITED,

Consulting Engineers.

Builders of UP-TO-DATE Machinery and Appliances for Coal and Water Gas Plants. :: :: :: :: ::

PLANS, SPECIFICATIONS AND ESTIMATES PREPARED.

AMERICAN OFFICE:
269 Front St., East, Toronto, Canada.

ARTHUR E. BOARDMAN, C.E.,

For several years associated with the late CAPTAIN WILLIAM HENRY WHITE,

WILL CONTINUE THE BUSINESS OF

CONSULTING ENGINEER

For Gas, Water and Electric Light Companies, at
No. 41 Wall Street, Room 1707, New York.
TELEPHONE, 5534 BROAD.

Modern Machine Shop Construction, Equipment and Management,

By OSCAR E. PERRIGO, M.E.,

Member American Society of Mechanical Engineers. Expert in Machine Shop and Factory Organization, Modern Shop Methods, Time and Cost Systems, etc.

Nearly 400 Large Quarto Pages, Illustrated by over 200 Engravings Specially Made by the Author. A work designed for the practical and everyday use of the Architect who designs, the Manufacturers who build, the Engineers who plan and equip, the Superintendents who organize and direct, and for the information of every Stockholder, Director, Officer, Accountant, Clerk, Superintendent, Foreman and Workman of the Modern Machine Shop and Manufacturing Plant of Industrial America.

PRICE, $5. For Sale by

A. M. CALLENDER & CO., - - - - - 42 Pine Street, New York City.

1906 DIRECTORY 1906

OF AMERICAN GAS COMPANIES.

Price, - - - - - - - - - $5.00.

A. M. CALLENDER & CO., 42 Pine Street, New York City.

WHY DO GAS EXHAUSTERS

AND HIGH PRESSURE GAS PUMPS BUILT BY

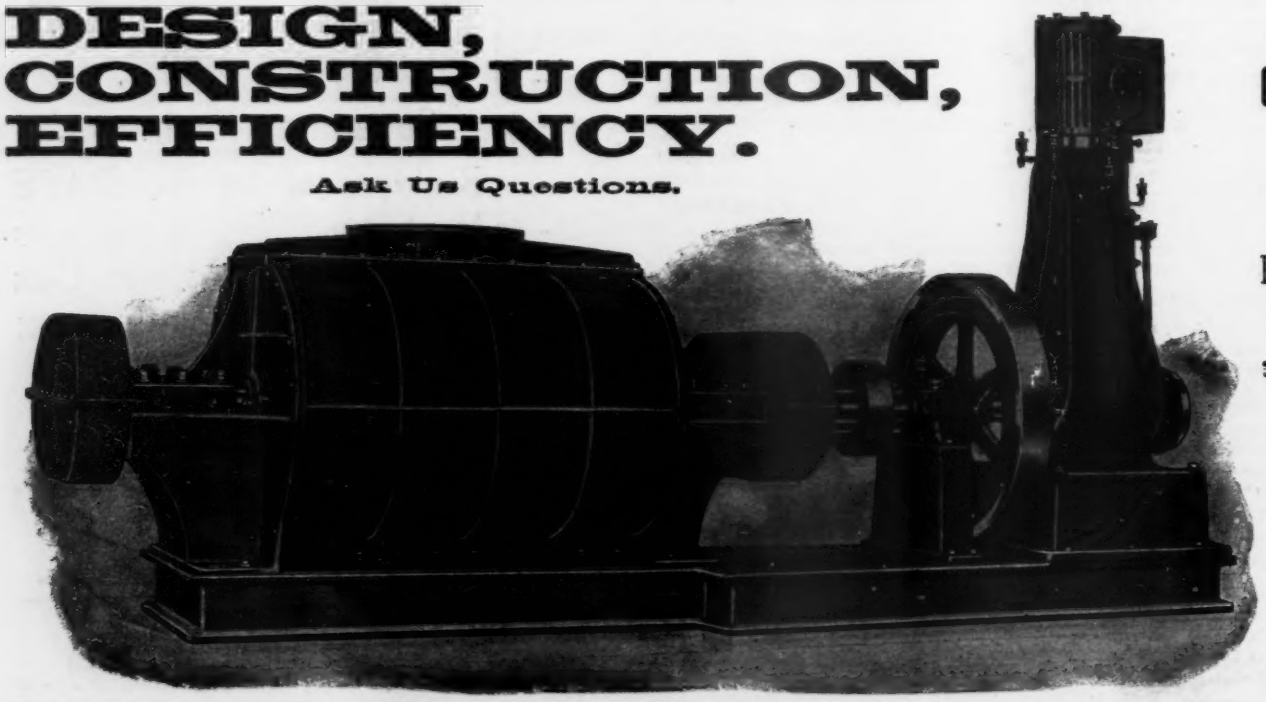
THE CONNERSVILLE BLOWER CO.

Stand so High in the estimation of those using them?

THE ANSWER IS IN THREE WORDS:

DESIGN, CONSTRUCTION, EFFICIENCY.

Ask Us Questions.



Home Office:
CONNERSVILLE, IND.

Eastern Sales Agent:
HORACE G. COOKE,
95 Liberty Street, New York City.

Write us about our Improved Stuffing Boxes.

Something Entirely New.

SCIENTIFIC BOOKS.

MODERN APPLIANCES IN GAS MANUFACTURE. By Fletcher W. Stevenson. $3.

MODERN GAS ENGINES AND PRODUCER GAS PLANTS. By R. E. Mathot. $2.50.

COAL TAR AND AMMONIA. By George Lunge. $15.

ELECTRIC GAS LIGHTING. By H. S. Norrie. 50 cents.

GAS ANALYST'S MANUAL. By J. Abady. $6.50.

COX'S GAS FLOW COMPUTER. $2.50.

GAS ENGINE DESIGN. By Charles Edward Lucke, Ph.D. $3.

THE "GAS WORLD" YEAR BOOK, 1906. Edited by John Douglas. $3.

GAS AND GAS WORKS. By Hughes and O'Connor. $2.50

POOLE ON FUELS. By Herman Poole. $3.

GAS ENGINEER'S POCKET-BOOK. By Henry O'Connor $3.50.

TECHNICAL GAS ANALYSIS. By Winkler & Lunge. $4.

GAS CONSUMER'S HANDYBOOK, by Wm. Richards. 20 cents.

PRACTICAL TREATISE ON HEAT. By Thomas Box. 2d edition. $5.

PRACTICAL PHOTOMETRY: A Guide to the Study of the Measurement of Light. By W. J. Dibdin. $3.

CHEMICAL TECHNOLOGY: Vol. I., *Fuel and Its Applications*, $5. Vol. II., *Lighting*, $4.

IRONWORK: Practical Designing of Structural Ironwork. By H. Adams. $3.50.

SELF-INSTRUCTION FOR STUDENTS IN GAS MANUFACTURE. Elementary, advanced and constructional, each, $1.50.

LIQUID FUEL FOR MECHANICAL AND INDUSTRIAL PURPOSES. By E. A. Brayley Hodgetts. $2.50.

HEMPEL'S GAS ANALYSIS, $2.25.

HANDBOOK FOR GAS ENGINEERS AND MANAGERS. Seventh edition. By Thomas Newbigging $6.50.

GAS, GASOLINE AND OIL ENGINES. By Gardner D. Hiscox. Fifteenth edition. $2.50.

PRACTICAL HANDBOOK ON GAS ENGINES, by G. Lieckfeld. $1.

HEAT A MODE OF MOTION. By John Tyndall. $2.50.

THEORY OF HEAT. By J. Clerk-Maxwell. $1.50.

MANUAL FOR GAS ENGINEERING STUDENTS. By D. Lee. 40 cents.

AMMONIA AND AMMONIUM COMPOUNDS. By Dr. R. Arnold. $2.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS. By D. A. Graham. $3.

A TEXT BOOK OF INORGANIC CHEMISTRY. By Prof. Victor Von Richter. $2.

ILLUMINATING AND HEATING GAS. By W. Burns. $1.50

HANDBOOK FOR MECHANICAL ENGINEERS. By H. Adams. $2.50.

GAS ENGINEER'S LABORATORY HANDBOOK. By Jno. Hornby. $2.50.

FINANCES OF GAS, ELECTRIC LIGHT AND POWER ENTERPRISES. By Wm. D. Marks. $2.50.

STANDARD REDUCTION FACTORS FOR GASES. By Helon Brooks MacFarland. $1.50.

PRACTICAL PLUMBING. By P. J. Davies. Vol. I. $3, Vol. II. $4.50.

AMERICAN SANITARY PLUMBING. By James J. Lawler. $2.

TREATISE ON MASONRY CONSTRUCTION. Baker. $5.

FIELD'S ANALYSIS, 1905. $5.

A COMPARISON BETWEEN THE ENGLISH AND FRENCH METHODS OF ASCERTAINING THE ILLUMINATING POWER OF COAL GAS. $1.60.

ELECTRICITY.

ELECTRIC WIRING DIAGRAMS AND SWITCHBOARDS By Newton Harrison, E.E. $1.50.

CARE AND MANAGEMENT OF ELECTRIC POWER PLANTS. By Norman H. Schneider. Cloth, $1.50. Leather, $2.50.

INDUSTRIAL PHOTOMETRY, with Special Application of Electric Lighting. By A. Palaz, Sc.D. $4.

ELEMENTS OF ELECTRIC LIGHTING, Including Electric Generation, Measurement, Storage and Distribution. By Philip Atkinson. $1.50.

ELECTRIC TRANSMISSION OF ENERGY. By G. Kapp. $3.50.

ELECTRICIAN'S POCKET-BOOK. By Monroe and Jamieson. $2.50.

DYNAMO BUILDING. By F. W. Walker. 50 cents.

DOMESTIC ELECTRICITY FOR AMATEURS. By E. Hospitalier. $2.50.

PRACTICAL MANAGEMENT OF DYNAMOS AND MOTORS. $1.

PRACTICAL GUIDE TO THE TESTING OF INSULATED WIRES AND CABLES. $1.

ELECTRIC LIGHTING, by Francis B. Crocker. $3.

ELECTRIC LIGHT FITTING. $2.

PRACTICAL ELECTRICITY. $2.50.

ELECTRICITY FOR ENGINEERS. $2.50.

ELECTRICITY, Its Theory, Sources and Applications. By John T. Sprague. $6.

The above will be forwarded upon receipt of price. If sent by mail or express, postage or express charges must be added to above prices. We take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances should be made by check, draft, or post office money order. No books sent C.O.D.

A. M. CALLENDER & CO., - - - - - 42 Pine Street, New York City.

DIRECTORS:

THOMAS G. MARSH, M. E.,
Chairman, the Rotary Meter Company, Ltd.
Manchester, England.

HENRY L. DOHERTY,
Henry L. Doherty & Co.,
New York.

Dr. F. SCHNIEWIND, Vice-Pres. and Gen. Mgr.,
United Coke and Gas Company,
New York City.

IRA C. COPLEY, President,
Western United Gas and Electric Company,
Aurora, Ill.

GEO. D. ROPER, President,
Eclipse Gas Stove Company,
Rockford, Ill.

FREDERICK H. SHELTON,
Engineer and Secretary various Gas Companies,
Philadelphia, Pa.

E. C. BROWN, President of the Company.

ROTARY STATION METER

A Few of the 300 Users of these Meters.

Name of Company.	Hourly Capacity.	To Measure.
Accrington Dist. Gas Board	30,000	Carburetted Water Gas.
Amsterdam Gas Works, Holland	30,000	Coal Gas Make.
British Gas Light Co., Norwich	3,500	Oxide Revivification.
" " " " Etruria	30,000	General Works Meter.
" " " " Hull	1,500	Oxide Revivification.
Cleckheaton Gas Co	30,000	General Works Meter
Cleethorpes Gas Co	25,000	Water Gas Make.
Croyden Commercial Gas and Coke Co	3,500	Oxide Revivification.
" " " "	80,000	Carburetted Water Gas.
" " will install	180,000	General Works Meter.
Danish Gas Works, Fredriksburg, Denmark	100,000	Coal Gas Make.
Elstev Gasmeterfabric, Rotterdam, Holland	2,800	For Testing Meters.
Gas Light and Coke Co., London	5,000	Oxide Revivification.
" " "	3,500	" "
" " "	3,500	" "
Gas Anstalt, Hanover, Germany	100,000	General Works Meter.
Halifax Corporation	100,000	Carburetted Water Gas.
Hastings and St. Leonards Gas Co	100,000	General Works Meter.
Hanover Gas Works, Hanover, Germany	100,000	" " "
Kidderminster Gas Light and Coke Co	60,000	" " "
Liverpool United Gas Co	10,000	Oxide Revivification.
Shanghai Gas Co	40,000	Carburetted Water Gas.
" "	75,000	Mixed Coal and Water Gas.
South Metropolitan Gas Co., London	5 each 10,000	Oxide Revivification.
South Staffordshire Gas Co	(70 with capacity from) (2,800 to 500,000)	Producer Gas.
Stockholm Gas Co., Sweden	100,000	Mixed Coal and Water Gas.
Worthing Gas Light and Coke Co	60,000	General Works Meter.

We have been permitted by the recipients, an American constructing concern, to reproduce the following letters recently received in reply to inquiry respecting Rotary Station Meters made of three important English gas works' engineers, all of whom enjoy enviable reputations and are everywhere among their fellow workers recognized for the skill, ability and success which has attended their administrations of the properties with which they are connected. The originals of these letters, together with many more of similar tenor, are on file in our office and open to the inspection of any prospective purchaser of Rotary Station Meters.

DEAR SIRS:

In answer to yours of the 27th March, I have pleasure in stating that we have had an 80,000 cu. ft. per hour Rotary Station Meter in use in connection with our Water Gas Plant for almost 18 months; during the greater part of this time we worked in series with our ordinary station meter, and found its registration accurate. I am so satisfied with it that I am about to place an order with the firm for a meter to pass 180,000 cu. ft. per hour of coal gas.

Yours faithfully, _____

DEAR SIRS:

In reply to your enquiry of the 27th March *re* Rotary Meter, I have not the slightest hesitation in stating that the meter we have in use here is giving every satisfaction.

It is 15,000 cu. ft. per hour and fixed at the outlet of Condensers of our Carburetted Water Gas Plant, and of course in the inlet of the Relief Holder, and is working under extreme conditions.

It is fixed underground, and since we have had it, *viz.*, 3 years, we have only taken it out once for examination (and this out of curiosity); as you will quite understand, there is a lot of oil, tar, etc., in contact with the meter at this point, and we thought it might be getting clogged up, but were pleased to find that such was not the case.

From our experience we have not the slightest hesitation in recommending its adoption to all gas makers.

I shall be pleased to reply further if necessary.

Yours very faithfully, _____

GENTLEMEN:

In reply to yours of March 27th respecting the Rotary Station Meter in use at these Works, I beg to inform you that the same has given every satisfaction. The meter has been registering the whole of the gas made at our Inclined Retort Section for the past 2½ years, and up to the present time we have not had the slightest trouble. The capacity of our meter is 100,000 cu. ft. per hour.

Yours truly, _____

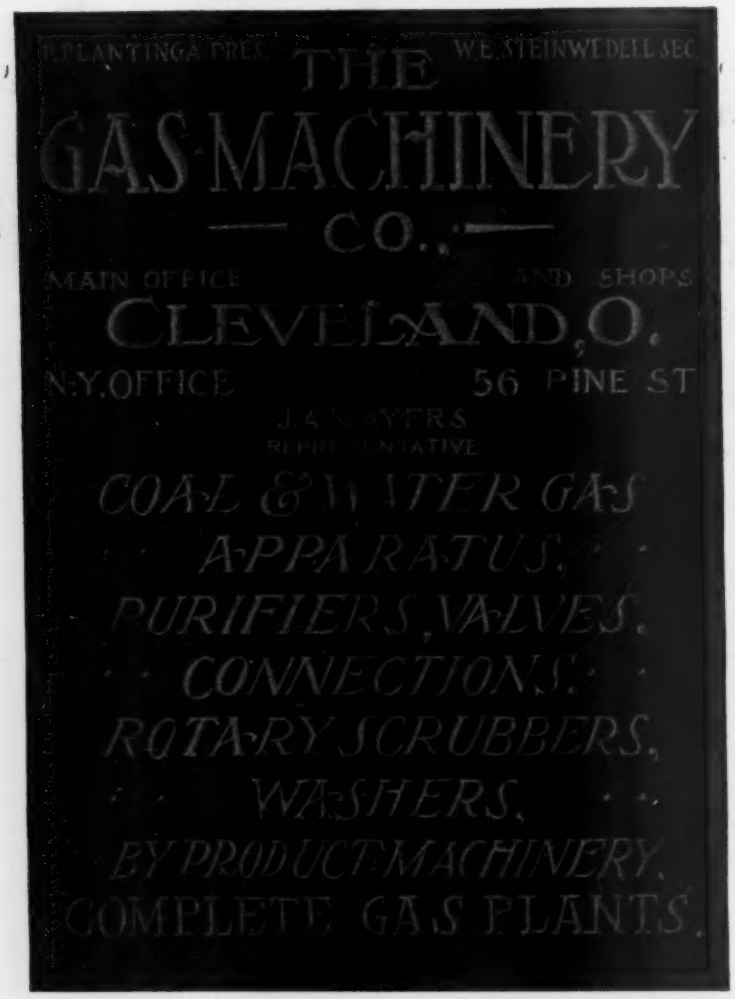
One-half the Cost—One-tenth the Space.

When in Need of Station Meters Write

ROTARY METER COMPANY,

Send for Catalogue.

280 Broadway, New York City.



PRACTICAL PHOTOMETRY,

By WILLIAM JOSEPH DIBDIN,

PRICE, $3. FOR SALE BY

A. M. CALLENDER & CO., 42 Pine Street, New York City.

PATENTS, TRADE MARKS, COPYRIGHTS.

ROYAL E. BURNHAM,

Solicitor of Patents and Counsellor in Patent Causes.

833 Bond Building, Washington, D. C.

Send for Pamphlet on Patents.

Bristol's Recording

Pressure Gauge,

STANDARD FORM, NEW PORTABLE FORM,

For Continuous Records of

Street Gas Pressure.

Simple in Construction, Accurate in Operation and Low in Price.

Fully Guaranteed. Send for Catalog A.

THE BRISTOL CO.,

Waterbury, Conn., U.S.A.

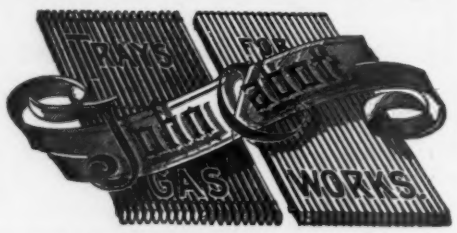
New York—114 Liberty Street,
London—23 College Hill.

Gold Medal, St. Louis Exposition.

Church's Patent Trays.

Reversible; Strongest; Most Easily Repaired.

Special Trays for Iron Sponge.



1412-1416 Adams Street, Hoboken, N. J.

We also Supply the Cheapest and Strongest

•Reversible Bolted Trays•

IN THE MARKET.

SEND FOR BOOKLET AND CIRCULARS.

THE BEST are THE CHEAPEST.

HOMOGENEOUS CONSTRUCTION ~ PERFECT FINISH ~ LONGEST CONTINUOUS LIFE.

WE HAVE RETORTS MAKING GAS TO-DAY THAT HAVE BEEN IN CONSTANT USE FOR 52 MONTHS.

Awarded the Only **GRAND PRIZES** At St. Louis Exposition

BY A JURY COMPOSED OF THE MOST COMPETENT ENGINEERS OF FOUR CONTINENTS, FOR SUPERIOR

RETORTS * GAS BENCHES * FIREBRICK.

Designs and Estimates Cheerfully Furnished.

LACLEDE FIREBRICK MANUFACTURING COMPANY,

ST. LOUIS, MO.

In Watertown, N. Y.

In many cities evening shopping centers are created by the united efforts of neighboring merchants in grouping their

HUMPHREY

OUTDOOR LAMPS.

NEW YORK:
46 West Broadway.
OAKLAND, CAL.:
1119 Jefferson Street
(TEMPORARILY).

GENERAL GAS LIGHT CO.,
KALAMAZOO, MICH.

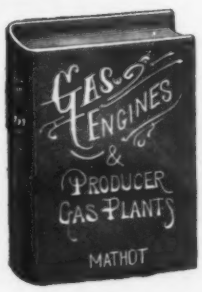
The "Gas World" Year Book,
1906,
Edited by JOHN DOUGLAS.

Technical Data, Diary and Handy Tables for Gas Engineers and Managers, Directory of English Gas Companies, Analyses of Accounts of Gas Undertakings, etc.

Price, $3. For Sale by

A. M. CALLENDER & CO., - 42 Pine Street, New York City.

MODERN GAS ENGINES and PRODUCER GAS PLANTS,



By R. E. MATHOT, M.E.,

Containing a Preface by DUGALD CLERK, F.C.S, indorsing the Book.

A PRACTICAL Treatise of 320 pages, Fully Illustrated by 175 Detail Illustrations, Setting Forth the Principles of Gas Engines and Producer Design, the Selection and Installation of an Engine, Conditions of Perfect Operation, Producer Gas Engines and their Possibilities, the care of Gas Engines and Producer Gas Plants, with a Chapter on Volatile Hydrocarbons and Oil Engines.

PRICE, $2.50. For Sale by

A. M. CALLENDER & CO., - 42 Pine Street, New York City.

WHAT UNCLE SAM'S EXPERTS SAY OF BRAY BURNERS.

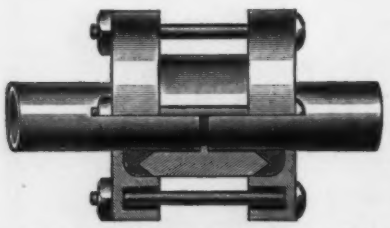
The United States Government Inspector of Gas,

in an Annual Official Report, has stated: "In particular, was attention given to inspection of **BRAY'S "Special" Slit-Union** and **"Special" Union-Jet Burners.** The "Special" Burners manufactured by **Geo. Bray & Co.** compare favorably with any yet inspected by this office; **they are well made** and no doubt will prove very durable in practical use. The result of test with **BRAY'S Standard Slit-Union was highly satisfactory;** it will yield the maximum candle power obtainable from a cubic foot of gas."

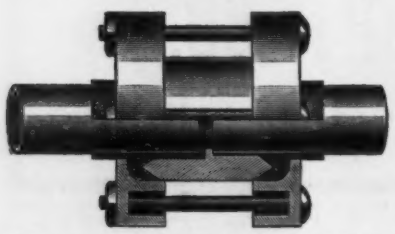
A Postal Brings our Blue Book.

W. M. CRANE COMPANY,

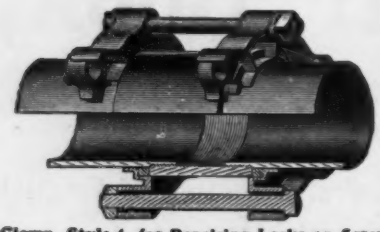
WE MAKE GAS APPLIANCES OF ALL KINDS. SOLE AGENTS FOR THE UNITED STATES AND CANADA.



Regular Coupling, Style 1, for Plain End Wrought Iron Pipe.



Insulating Coupling, Style 5, for Plain End Wrought Iron Pipe.



Clamp, Style 4, for Repairing Leaks on Screw Collar.

Long Sleeve, Style 2, for Mending Broken Lines.

S. R. DRESSER MANUFACTURING CO.,

SUCCESSORS TO

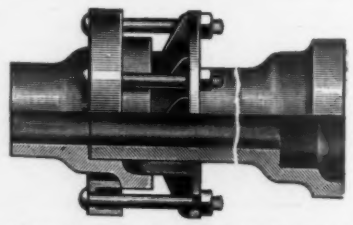
S. R. DRESSER,

BRADFORD, PA., U. S. A.,

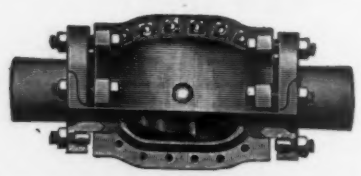
Patentee and Manufacturer of Specialties for Gas and Water Lines,

Pipe Couplings, Sleeves, Clamps, Crosses, Tees and Ells.

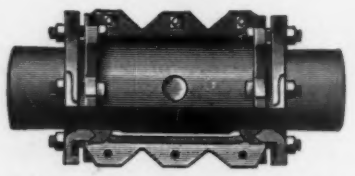
STATE REQUIREMENTS AND SEND FOR CATALOGUE.



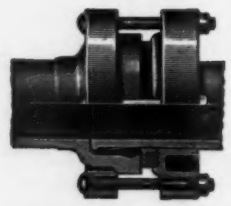
Coupling, Style 9, for Special Style Cast Iron Pipe.



Split Sleeve for Repairing Broken Bell on Cast Iron Pipe.



Split Sleeve for Repairing Broken or Cracked Cast Iron Pipe.



Clamp, Style 4½, for Repairing Leaky Lead or Cement Joints in Cast Iron Pipe.

STEWARD'S EASTERN DEPOT.

For the convenience of Eastern gas companies and dealers we now have a full stock of Steward Burners and Lava Gas Tips in New York city. Your orders will be filled promptly.

D. M. STEWARD MFG. CO., Established 1876,

47 Murray Street, New York.
Fensterer & Ruhe, Agents.

CHATTANOOGA, TENN.

PRACTICAL HANDBOOK ON GAS ENGINES, WITH INSTRUCTIONS FOR CARE AND WORKING OF THE SAME,

By G. LIECKFELD, C.E. Translated with Permission of the Author, by GEO. M. RICHMOND, M.E. Price, $1.00.

A. M. CALLENDER & CO., 42 PINE ST., NEW YORK CITY.

H. M. Byllesby & Company

(Incorporated),

GAS ENGINEERS,

DESIGN, CONSTRUCT AND OPERATE COMPLETE COAL, WATER AND CRUDE OIL GAS PLANTS.

HIGH AND LOW PRESSURE DISTRIBUTING SYSTEMS.

AMERICAN TRUST BUILDING,

CHICAGO.

THE AMERICAN STANDARD COMPOSITION CO.

—) MANUFACTURES (—

HEAT PROOF AND DAMP PROOF PAINTS

For Structural Iron and Steel, Gas Apparatus, Underground Piping, Boiler Fronts, Stacks, etc.

Our Paints will not crack, peel or scale. Heat does not affect them. They are moisture proof.

They are the Paints that Don't Come Off!

We let you Try before you Buy. Send for samples and prices.

AMERICAN STANDARD COMPOSITION COMPANY,

1707, Wall Street Exchange Building, New York.

FOR HOT BATHS,

And for every other Hot Water Need, use the

IMPROVED

HUMPHREY CRESCENT INSTANTANEOUS WATER HEATERS.

Efficient. Compact. Durable. Every Heater Guaranteed.

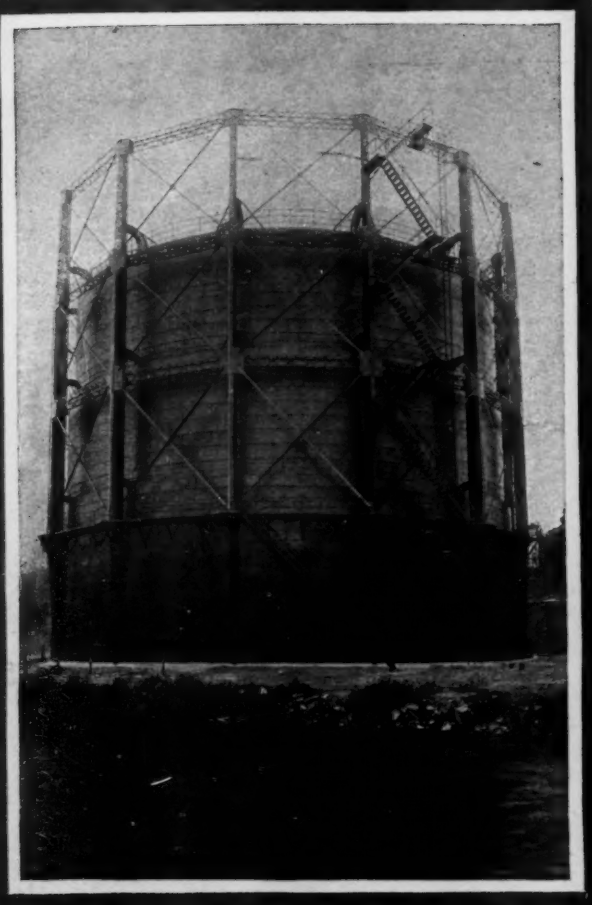
No. Heater.	Price.	Gas Supply from Meter.	Heats Gals. per Min. 50° in Temperature.	Height.	Diameter.	Shipping Weight.
Non-Contact 2	$40.00	¾ Inch.	2½	34⅝ Inches.	12 Inches.	70 Pounds.
" 1	34.00	¾ "	2	31 "	10¾ "	62 "
Contact 6	27.00	¾ "	3	29¼ "	12 "	60 "
" 8	23.50	¼ "	2½	28½ "	10¼ "	48 "
" 9	20.00	¾ "	1	24 "	9¼ "	45 "

These prices include Safety Valves and Unions, one Bent Output Spout. For prices of fittings see our complete catalogue, "The Luxury of a Bath."

We will be glad to quote discounts.

HUMPHREY CO., · · · Kalamazoo, Mich.

The ONLY manufacturers in the world of a complete line of Instantaneous Water Heaters.



ARTHUR R. CRUSE
President

A. E. KEMPER
Treasurer

HENRY W. SCATTERGOOD
Vice-President

FRANK FLAVELL
Secretary

CRUSE-KEMPER COMPANY

PHILADELPHIA OFFICES
1205-6 Stephen Girard Building

WORKS
Ambler, Pa

Manufacturers of

TRIPLE
DOUBLE and
SINGLE-LIFT

Gas Holders

WITH OR WITHOUT
METAL TANKS

Oil and Water Tanks
Purifier Covers
General Plate Metal Work and
Steel Water Towers

PLANS, SPECIFICATIONS AND ESTIMATES
PROMPTLY FURNISHED ON REQUEST

J. S. DeHART, JR.,
PRESIDENT

A. F. WEHNER,
SECRETARY

R. K. WEHNER,
TREASURER

ISBELL-PORTER COMPANY

GAS ENGINEERS & BUILDERS OF GAS WORKS

BENCH WORK

CHARGING AND
DISCHARGING
MACHINERY

MACKENZIE
EXHAUSTERS

PRIMARY AND
SECONDARY
CONDENSERS
FOR FRESH
OR SALT WATER

ISBELL VALVES
SPECIALS

TAR
EXTRACTORS

P.&A. TAR EXTRACTORS
FOR WATER GAS

ROTARY AMMONIA
SCRUBBERS

SHAVING
SCRUBBERS
PURIFIERS
STREET GOVERNORS

MAIN OFFICE AND WORKS
BRIDGE & OGDEN STREETS
NEWARK, N.J.
ESTABLISHED 1865

EMPIRE GAS IMPROVEMENT AND CONSTRUCTION CO.,

Contractors for the Installation of

COMPLETE GAS WORKS OR ANY PART THEREOF, INCLUDING

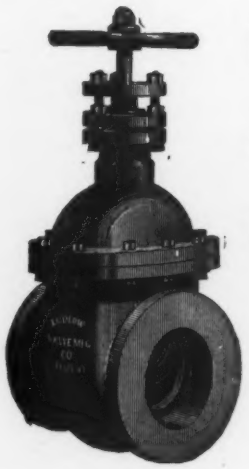
Houses, specially designed for room and economy.
Holders of any desired capacity, with or without Steel Tank.
Coal Gas Benches of every approved setting.

Standard Lowe Double Superheater Water Gas Sets.
Lowe-Sutherland Double Superheater Water Gas Sets.

Boilers, Engines, Blowers, Coal Elevators, Purifying Boxes, Tar Extractors, Scrubbers, Condensers, Exhausters, Station Meters, Street Mains and Governors.

Where necessary we give Bond in any required sum to guarantee speedy *completion* and *results.*

EMPIRE GAS IMPROVEMENT AND CONSTRUCTION CO., 49 Wall St., New York.



THE

Ludlow Valve Mfg. Co.,

TROY, N. Y., U. S. A.

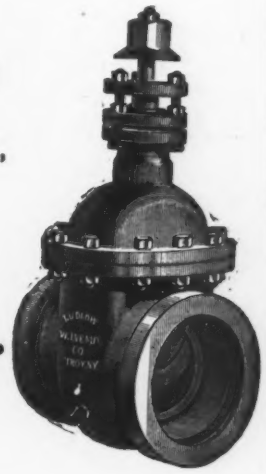
Double and Single Gate Valves, ¼" to 72",

—FOR—

Gas, Water, Steam, Oil, Ammonia, Etc.

HOT GAS VALVES A SPECIALTY.

Send for Catalogue.



Cox's High Pressure Fluid Discharge Computer.

This Computer solves the following formula, which is applicable to Gas, Air and other elastic fluids, flowing through long pipes with high initial pressures:

Discharge in cubic feet per hour at atmospheric pressure $= 33.3 \sqrt{\frac{d^5 \times (p_1^2 - p_2^2)}{L \times w}}$

Where

d = diameter of pipe in inches,
p_1 = absolute initial pressure in pounds per square inch,
p_2 = absolute terminal pressure in pounds per square inch,
L = length of pipe in miles,
w = specific gravity of the fluid when air = 1.

To Find the Discharge from a Pipe and the Required Size of Pipe.

(1.) Set the specific gravity of the fluid opposite the length of pipe;

(2.) Bring the DIFFERENCE of the initial and terminal gauge pressures opposite the SUM of the initial and terminal gauge pressures;

(3.) Opposite any diameter of pipe will now be found the discharge in cubic feet per hour at atmospheric pressure; and

(4.) Opposite any desired discharge will also be found the required diameter of pipe.

Price of the Computers, in Cloth Case, 6½ x 8 inches, $5 Each, Net.

For Sale by

A. M. CALLENDER & CO., 42 Pine Street, New York City.

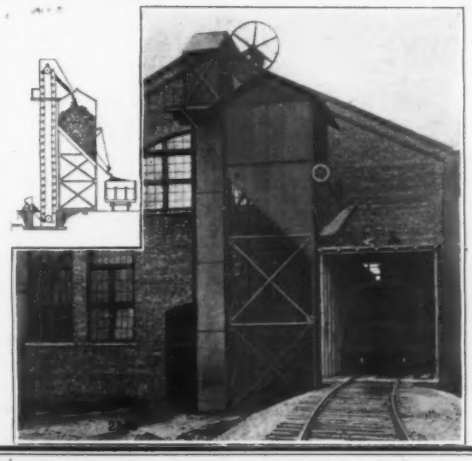
Coal and Ashes Conveying.

Every manufacturing and power plant should have a quick and economical equipment—a Link-Belt installation—that pays for itself in a short time by reason of the all-round superiority that marks its design and operation.

Illustration shows ashes elevator enclosed in dust-proof casing, installed for Crucible Steel Co., Jersey City, N. J.

THE LINK-BELT ENGINEERING CO.
Philadelphia.

NEW YORK: 49 Dey St. PITTSBURGH: Park Bldg.
CHICAGO: Link-Belt Machinery Co.



J. F. W. JOST,

CHEMICAL ENGINEER

—IN—

GAS MANUFACTURE,

P. O. BOX 2043, PHILADELPHIA, PA.

COKE CAR.

"Industrial Railway."

HUNT PATENT offers conveniences and advantages which cannot be obtained in any other manner. Cars run around curves of 12 feet radius on a 21¼-inch gauge track as easily as a wagon turns a corner. Send for our new edition of "Industrial" Railways.

C. W. HUNT CO., Davis Av., West New Brighton, N. Y.

The Gas Engineer's Laboratory Handbook,

By JOHN HORNBY, F.I.C.

Price, $2.50.

A. M. CALLENDER & CO., 42 Pine St., N. Y. City.

THE

Valuation of Gas, Electricity and Water Works

FOR ASSESSMENT PURPOSES.

THOS. NEWBIGGING, M.Inst.C.E., and WM. NEWBIGGING, Assoc.M.Inst.C.E.

With an Appendix of Decided Cases.

Second Edition. Price $2. For Sale by

A. M. CALLENDER & CO.,
42 Pine Street, N. Y. City.

INTENSIVE SCRUBBERS.

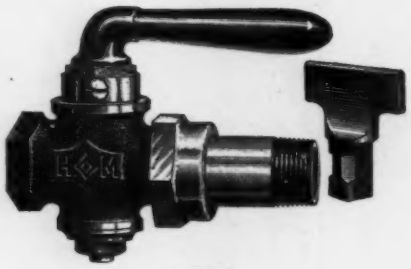
TOWER TYPE.
TRIPLE EFFICIENCY.

Western Sales Agent
BARTLETT, HAYWARD & CO., Baltimore, Md.

LLOYD CONSTRUCTION CO., Detroit, Mich.

MUELLER GAS STOVE COCKS

With Ball Joint Coupling.



C—1337.

These cocks can be fit in without the ends of the pipes being on the same line. The ball joint gives the coupling a range of adjustment that allows it with the attached pipe to set at a considerable angle with the body of the cock, and be gas tight.

THE MARK OF UNCONDITIONAL DECATUR H⊘M ILL. U.S.A. GUARANTEE MUELLER GOODS

H. MUELLER MFG. CO.,

Decatur, Ill., U. S. A. New York, N. Y., U. S. A.

BINDER

FOR THE

JOURNAL.

PRICE, $1.

FOR SALE BY

A. M. CALLENDER & CO., - 42 Pine St., New York.

ROOTS' GAS EXHAUSTERS.

GOLD MEDAL AT ST. LOUIS, 1904.

Installation showing our latest improved machines, with flexible rope coupling, for large units.

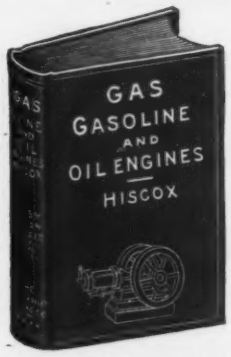
SEND FOR CATALOGUE.

HOME OFFICE:
Connersville, Ind.

NEW YORK OFFICE:
120-122 Liberty St.

CHICAGO OFFICE:
1547 Marquette Building.

JUST PUBLISHED, 15TH EDITION, REVISED, ENLARGED AND RESET.



Gas, Gasoline and Oil Engines,

INCLUDING GAS PRODUCER PLANTS,

By GARDNER D. HISCOX, M.E.

Author of "MECHANICAL MOVEMENTS," "COMPRESSED AIR," Etc.

PRICE, - - - - - $2.50.

The only complete American book on the subject for Gas Engine Owners, Gas Engineers and intending purchasers of gas engines, treating fully on the construction, installation, operation and maintenance of gas, gasoline, kerosene and crude petroleum engines.

The new rewritten, enlarged and revised 15th edition of this work has been prepared to meet the increasing demand for a thorough treatise on the subject. Its 450 pages give general information for everyone interested in this popular motive power and its adaptation to the increasing demand for a cheap and easily managed motor requiring no licensed engineer. It is fully illustrated by 351 Engravings and Diagrams. For sale by

A. M. CALLENDER & CO., - - - - - 42 Pine Street, New York City.

Gas Companies' Bookkeeping,

1906 EDITION,

By JOHN H. BREARLEY and BENJAMIN TAYLOR.

A Practical Treatise on the Keeping of Gas Companies' Accounts,

WITH USEFUL

FORMS FOR GAS UNDERTAKINGS.

PRICE, CLOTH, $4.50, MOROCCO, $6.50.

FOR SALE BY

A. M. CALLENDER & CO., - - - 42 Pine Street, New York City.

GEORGE ORMROD, Mangr. & Treas., Emaus, Pa.
JOHN DONALDSON, Prest., Betz Bldg., Phila., Pa.

EMAUS PIPE FOUNDRY.

DONALDSON IRON COMPANY. EMAUS, PA.

CAST IRON GAS & WATER PIPE

MANUFACTURERS OF

CAST IRON PIPE AND SPECIAL CASTINGS

FOR WATER AND GAS.

Also, FLANGE PIPE, LAMP POSTS, Etc.

GAS TAPPING MACHINES

—FOR—

Drilling and Tapping Pipe under Pressure

WITHOUT ANY ESCAPE OF GAS.

They are Strong and Compact.

Size of Combination Drills and Taps ¾ to 4-inch.

Machines Sent to any Gas Company for Thirty Days' Trial.

Send for Circulars.

Geo. Light,
DAYTON, O.

"THE MINER"
Globe
Street and Boulevard
Lamps.

Cheapest and Best

THOUSANDS IN USE WITH INCANDESCENT BURNERS.

Send for Catalogues.

THOMAS T. W. MINER,
821-823 Eagle Av., N.Y.

GASHOLDER TANKS AND GAS WORKS MASONRY COMPLETE.

Plans prepared and Estimates furnished at short notice.

J. P. WHITTIER,
938 Java Street, Brooklyn, N. Y.

Practical Handbook on

GAS ENGINES,

With Instructions for Care and Working of the Same,

By G. LIECKFELD, C.E.
Translated with Permission of the Author,
By GEO. M. RICHMOND, M.E.

Price, $1. For Sale by
A. M. CALLENDER & CO.,
No. 42 Pine Street, New York City.

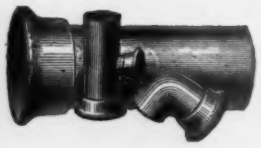
Gas Engineer's Pocket-book, —BY— HENRY O'CONNOR,

Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution and Use of Coal Gas, and the Construction of Gas Works. PRICE, $3.50. For Sale by
A. M. CALLENDER & CO., 42 Pine St., N.Y. City.

WARREN FOUNDRY AND MACHINE CO.,

Established 1856. Works at Phillipsburgh, N. J.

New York Office, 160 Broadway.



CAST IRON WATER AND GAS PIPE,

FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc.

SAFETY GAS MAIN STOPPER COMPANY,

For Shutting Off Gas in Mains Temporarily during alterations and repairs. : : : :

Any size gas main can be shut off in 30 seconds. : : :

STOPPERS SENT ON TRIAL.

Address: SAFETY GAS MAIN STOPPER CO., 552 E. 135th St., New York City.

Coke and ashes-handling Telpher installed for the Lowell Gas Light Co., Lowell, Mass.

TELPHERAGE FOR GAS WORKS.

Telpherage is the best system ever devised for transporting material at gas plants; in utility, economy, and efficiency, it is rapidly demonstrating its superiority.

State your case and ask for booklet 53.

UNITED TELPHERAGE DEPARTMENT

The Dodge Coal Storage Co.

Philadelphia—Hunting Park Ave. and P. & R. Ry.
New York—49 Dey Street.
Boston—164 Federal Street.
Chicago—39th Street and Stewart Avenue.
Pittsburgh—1501-2 Park Building.
Portland, Ore.—309 McKay Building.

Chollar's System of Gas Purification.

THE PURIFIED GAS REVIVES THE FOULED OXIDE.

BELT CONVEYORS

EQUIPPED WITH

BALL BEARING ROLLS

ARE THE BEST,

because they possess greater efficiency, consume less power, and the belts last longer than when any other type of roll is employed.

PLANS AND ESTIMATES FURNISHED ON REQUEST.

The Link-Belt Machinery Co.

Link-Belt Engineering Co. Philadelphia Chicago. U.S.A.

AMERICAN METER CO.,

NEW YORK, ST. LOUIS, PHILADELPHIA, SAN FRANCISCO, CHICAGO,

Photometrical and Experimental Apparatus.

PUBLIC LIGHTING TABLE.

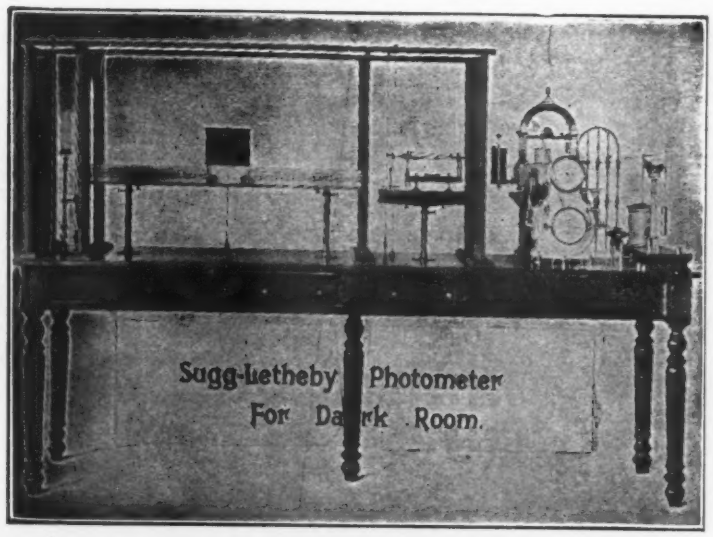
JULY, 1906.

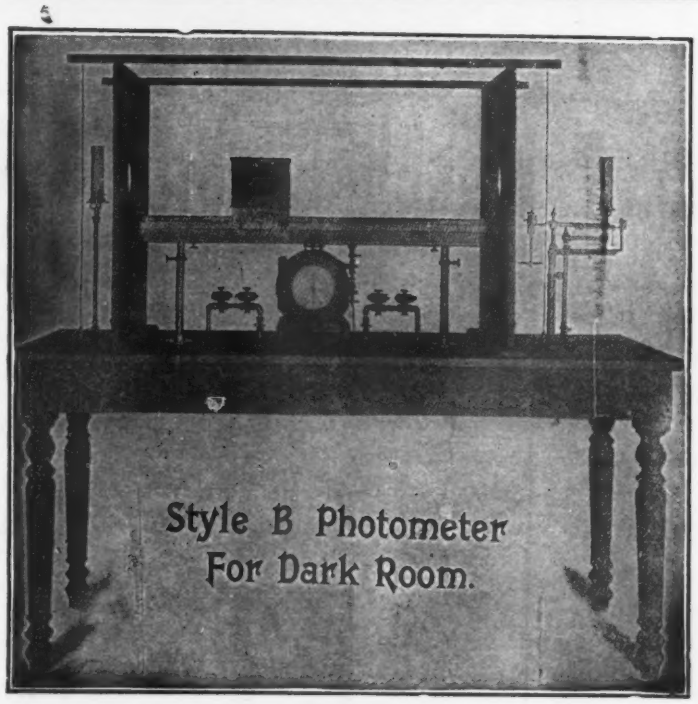
Day of Week.	Date.	Table No. 1. FOLLOWING THE MOON. Light.	Extinguish.
Sun.	1	12.40 AM	3.40 AM
Mon.	2	1.20	3.40
Tue.	3	2.10	3.40
Wed.	4	No L.	No L.
Thu.	5	No L. FM	No L.
Fri.	6	No L.	No L.
Sat.	7	8.00 PM	9.50 PM
Sun.	8	8.00	10.30
Mon.	9	8.00	11.10
Tue.	10	8.00	11.40
Wed.	11	8.00	12.10 AM
Thu.	12	8.00 LQ	12.40
Fri.	13	8.00	1.10
Sat.	14	8.00	1.40
Sun.	15	8.00	2.10
Mon.	16	8.00	2.40
Tue.	17	8.00	3.20
Wed.	18	8.00	3.50
Thu.	19	8.00	3.50
Fri.	20	8.00	3.50
Sat.	21	8.00 NM	3.50
Sun.	22	7.50	3.50
Mon.	23	7.50	3.50
Tue.	24	7.50	3.50
Wed.	25	7.50	3.50
Thu.	26	9.30	3.50
Fri.	27	10.00	3.50
Sat.	28	10.40 FQ	3.50
Sun.	29	11.20	4.00
Mon.	30	12.00	4.00
Tue.	31	12.50 AM	4.00

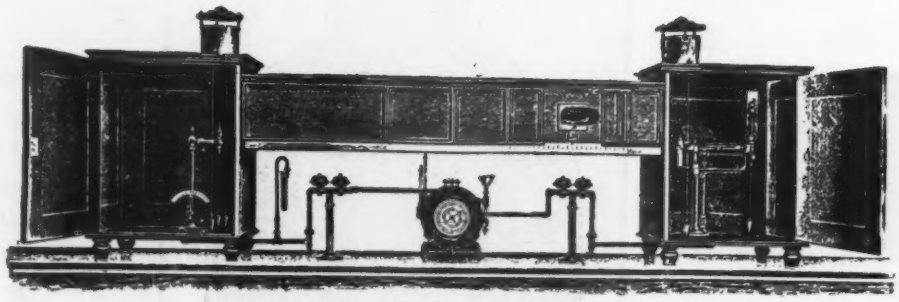
TOTAL HOURS DURING 1906.

By Table No. 1.

	Hrs.Min.
January	223.40
February	190.40
March	192.10
April	167.00
May	152.20
June	142.10
July	150.20
August	157.40
September	170.00
October	185.10
November	201.40
December	214.00
Total, yr.	2146.50







Closed Photometer For Light Room.

CIRCULARS SENT ON REQUEST.

PUBLIC LIGHTING TABLE.

JULY, 1906.

Day of Week.	Date.	Table No. 2. NEW YORK CITY. All Night Lighting. Light.	Extinguish.
		P. M.	A.M.
Sun.	1	7.30	3.15
Mon.	2	7.30	3.15
Tue.	3	7.30	3.15
Wed.	4	7.30	3.15
Thu.	5	7.30	3.15
Fri.	6	7.30	3.15
Sat.	7	7.30	3.15
Sun.	8	7.30	3.15
Mon.	9	7.30	3.15
Tue.	10	7.30	3.15
Wed.	11	7.30	3.15
Thu.	12	7.30	3.15
Fri.	13	7.30	3.15
Sat.	14	7.30	3.15
Sun.	15	7.30	3.15
Mon.	16	7.20	3.15
Tue.	17	7.20	3.15
Wed.	18	7.20	3.15
Thu.	19	7.20	3.15
Fri.	20	7.20	3.15
Sat.	21	7.20	3.15
Sun.	22	7.20	3.15
Mon.	23	7.20	3.15
Tue.	24	7.20	3.15
Wed.	25	7.20	3.15
Thu.	26	7.20	3.15
Fri.	27	7.20	3.15
Sat.	28	7.20	3.15
Sun.	29	7.20	3.15
Mon.	30	7.10	3.30
Tue.	31	7.10	3.30

TOTAL HOURS DURING 1906.

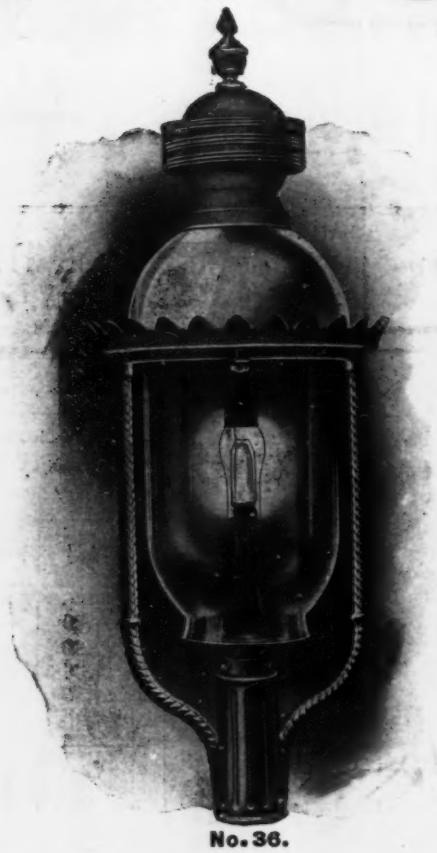
By Table No. 2.

	Hrs.Min.
January	423.20
February	355.25
March	355.35
April	298.50
May	264.50
June	234.25
July	243.45
August	280.25
September	321.15
October	374.30
November	401.40
December	433.45
Total, yr.	3987.45

NEW YORK, 318 West 42d Street.
BOSTON, 820 Beacon Building.
PHILADELPHIA, Broad and Arch Streets.
ST. LOUIS, 712 Roe Building.
CHICAGO, 218 La Salle Street.
SAN FRANCISCO, 512 Oak Street.

WELSBACH STREET LIGHTING COMPANY

....OF AMERICA....



No. 36.

Controls and Operates the **Welsbach System of Street Lighting,**

Which includes its specially DESIGNED and PATENTED BURNER for PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

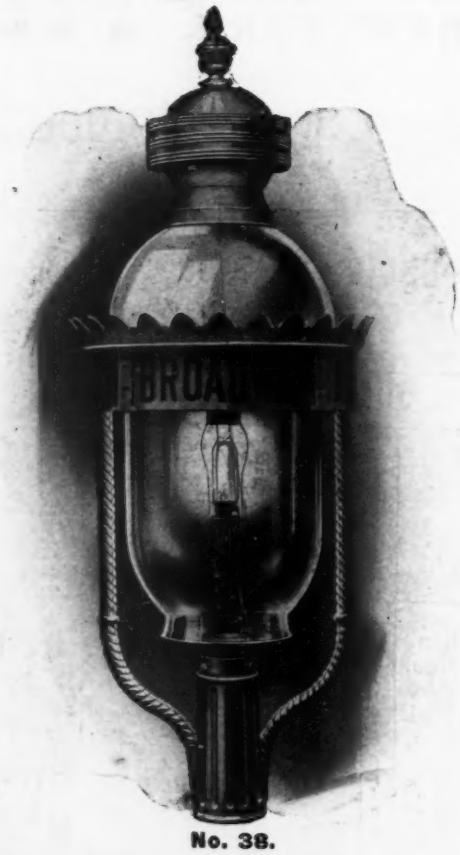
POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.



No. 38.

THE NEW NO. 7 WELSBACH DINING ROOM FIXTURE.

PRICE, EACH, COMPLETE, WITH SHADE, FRINGE, MANTLE AND CHIMNEY, $14. PER DOZ., $150. DISCOUNT, 50 PER CT.

Standard Length, 30 inches.
The New No. 7 Welsbach Dining Room Fixture, when ordered, will be sent complete, as follows:

1 No. 7 Harp Fixture and Brass Crown finished in Brushed Brass.
1 No. 66 Welsbach Burner (high candle power).
1 No. 4 Pilot By-pass.
1 No. 4197 Mantle — Intensive Brand.
1 No. 306 Chimney (air hole).
1 Fourteen-inch GREEN Art Glass Shade, with six-inch Green Beaded Fringe.

VARIATIONS.

Finished in oxidized copper, oxidized brass, etc., 25 cents extra.

Shades in Ruby and Green--Ruby, Amber and other colors, without extra charge.

Special colors require a few days extra time to fill orders.

Green Shades will be shipped unless otherwise ordered.

This fixture is being largely used by Gas Companies as a dining room fixture at the popular retail price of $10 complete, and is a great favorite for moderate sized two and three-story residences. In popularity and price it is unequalled.

WELSBACH CO.,

Salesrooms in All the Principal Cities of the United States.

Factories:

GLOUCESTER, N. J.
CHICAGO, ILL.

THE UNITED GAS IMPROVEMENT COMPANY

For the Year Ending December 31st, 1905, has been Awarded Contracts for 40 Sets of

Standard Double-Superheater Lowe Water Gas Apparatus.

PARTIAL LIST OF PLACES:

Catasauqua, Pa.
Plattsmouth, Neb.
Detroit, Mich. (2d contract).
Springfield, Ills.
Oneonta, N. Y. (2d contract).
Pottsville, Pa. (2d contract).
Evansville, Ind. (2d contract).
Lansdale, Pa.
Hempstead, N. Y. (2d contract).
New Britain, Conn.
New York, Mutual Co. (3d contract)
St. Louis, Mo. (4th contract).
Sioux City, Ia. (3d contract).
Amsterdam, N. Y.
Houston, Tex. (2d contract).
Hamilton, O. (2d contract).
Indianapolis, Ind. (2d contract).
Nanticoke, Pa.
Hazleton, Pa.
Mahanoy City, Pa.
Ludington, Mich.
Ossining, N. Y.
Lancaster, Pa.
Flushing, N. Y. (2d contract).
South Bend, Ind.
Fall River, Mass. (2d contract).
Minneapolis, Minn. (2d contract).

TOTAL SETS TO DECEMBER 31, 1905, ... 593
TOTAL DAILY CAPACITY TO DECEMBER 31, 1905, 463,780,000 CU. FT.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

Established 1858. Incorporated 1890.
CHAS. E. GREGORY, Prest. DAVID R. DALY, V.-Prest. & Treas.
H. D. ABERNETHY, Sec.

J. H. Gautier & Co.

Greene & Essex Streets,
Jersey City, N. J.

MANUFACTURERS OF

CLAY GAS RETORTS, FIRE CLAY TILES,
FIRE BRICK and FIRE CLAY SPECIALTIES.

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

SOLE MANUFACTURERS OF THE

FLEMMING GENERATOR GAS FURNACE

Brooklyn Fire Brick Works,

OFFICE AND WORKS:
88 VAN DYKE ST., BROOKLYN, N. Y.
MANUFACTURERS OF
CLAY GAS RETORTS & SETTINGS, GENERATOR LININGS. SPECIALTIES.

ST. LOUIS GAS CONSTRUCTION CO.,

DESIGNERS AND BUILDERS OF

COAL GAS BENCHES,

SPECIAL HIGH GRADE REFRACTORY MATERIAL FOR BENCH SETTINGS AND WATER GAS LININGS.

SOLE AGENTS FOR

CHRISTY SETTINGS.

CORRESPONDENCE SOLICITED.

ST. LOUIS, MO.

STANLEY'S CELEBRATED FIRE CEMENT
For the Repair of Clay and Iron Retorts & Firebrick Work, for the Protection of Ironwork when Exposed to a High Degree of Heat, and Excellent for Mouthpiece Joints.
In General Use in the United States and Canada.
Unlike Expensive Preparations,
THERE IS ABSOLUTELY NO WASTE.
F. W. STANLEY,
150 Nassau St., New York, N. Y.

ALBERT J. WEBER, President and General Manager.
Established 1846.

Adam Weber Sons.

Manhattan Fire Brick and Enameled Fire Clay Retort Works.

Works at Weber, on the Raritan River, Middlesex County, New Jersey.
GENERAL OFFICES:
Park Row Building, New York City.

Modern Coal Gas Benches,

With either Horizontal or Inclined Retorts, Half-Depth and Full-Depth Recuperative Furnaces.

ADAM WEBER PATENTS
STANDARD BENCH IRONWORK.

Linings for Water Gas Apparatus, High Grade Fire Brick of All Shapes and Sizes, Ground Fire Clay, Ground Fire Brick in Bulk or in Barrels.

ISAAC C. BAXTER, President.
Works, LOCKPORT STATION, PA.

ESTABLISHED 1864.

JAMES GARDNER, JR., CO.,

Successor to WILLIAM GARDNER & SON.

PETER YOUNG, Secretary and Treas.
Address all communications to JAMES GARDNER, JR., CO., Room 202 Lewis Bldg. PITTSBURGH, PA.

Fire Clay Goods for Gas Works.

ESTABLISHED 1868.
L. N. RANCKE, Vice-Pres. & Mgr. F. SCHIAFFINO, Sec'y & Treas.

BALTIMORE RETORT & FIREBRICK CO.

BALTIMORE, MD.,

Manufacturers of all Material for the Construction of Coal Gas Benches.

HALF AND FULL DEPTH AND FREE FIRING BENCHES,

All styles of which we have in operation, equipped with the BEST of LATEST IMPROVEMENTS, proving our claim for SUPERIOR QUALITY and EFFICIENCY.

INCLINES—We have in SUCCESSFUL OPERATION benches of Inclined Retorts, MANUFACTURED and ERECTED by us.

WALDO BROS., 102 MILK ST., BOSTON, MASS.,
Agents for New England States.

LARGE FACILITIES—Correspondence Solicited.
RAIL and WATER CONNECTIONS to ALL POINTS.

NATIONAL PYROGRANIT COMPANY,

MANUFACTURERS OF

Fire Brick, Tiles, Special Shapes, etc.

NEW YORK OFFICE:
17 Battery Place, New York.

WORKS:
South River, N. J.

ESTABLISHED 1856.
HENRY MAURER & SON,
Manufacturers of
High Grade Firebrick, Blocks, Tiles, ETC.,
Works: Maurer, N. J. Office: 420 E. 23d St., N. Y. City.

GEROULD'S IMPROVED RETORT CEMENT.

A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

Price List, f.o.b. PITTSBURGH, PA.
In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 200 " " 6 " "
In Kegs less than 100 " " 7 " "

C. L. GEROULD,
1200 Bank for Savings Bldg., Pittsburgh, Pa.

FIELD'S ANALYSIS FOR THE YEAR 1905.
An Analysis of the Principal Gas Undertakings in England, Scotland and Ireland. Being the 37th year of publication. Compiled and arranged by JOHN W. FIELD, Sec'y and Gen. Mgr. of The Gas Light and Coke Company, London. Price, $5. For Sale by
A. M. CALLENDER & CO., 42 Pine St., New York City.

JOHN DELL,
President and General Manager.

MISSOURI FIRE BRICK CO.,

ESTABLISHED 1882.

MANUFACTURERS OF

Gas Retorts, Bench Settings, Fire Brick, Cupola Linings, Etc.

We are the Exclusive Agents *for the* Mitchell Patent Benches, *Constructed with Half or Full Depth Furnaces, to Burn either Coal or Coke, and Arranged for Front or* Rear Clinkering. The Mitchell *is the* Original Coal Firing Bench. *We also Erect Plain Benches with* One *to* Six Retorts.

YOUR CORRESPONDENCE IS RESPECTFULLY SOLICITED.

City Office: *411 Olive Street, Continental Bank,* ST. LOUIS, MO.

Bronder Patent Stoking Machinery.

Three-Scoop and Three-Rake Charging and Discharging Machines are operating in New York, Newark, N. J., Philadelphia, Worcester, Mass., Mt. Vernon, N. Y., Toronto and Montreal, Canada.

Four-Scoop and Four-Rake Charging and Discharging Machines are operating in Detroit, Mich.

These are the only machines that will draw or charge simultaneously 3 or 4 retorts (vertically) and handle from 42 to 60 retorts in from 25 to 30 minutes, lid opening and closing and filling of furnaces included.

Hot Coke Conveyor, Quencher and Steam Exhauster, operating in Toronto, Canada, working in water-sealed flue, rollers being protected from heat and grit.

COAL CRUSHERS, CONVEYORS AND BINS. TURNTABLES FOR MACHINES.

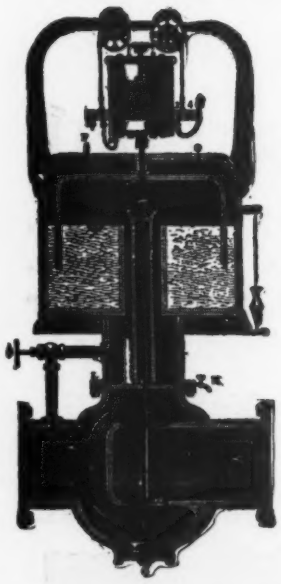
Labor-Saving Machines for Handling Coal and Coke from Coal Cars to Coke Yard or Bins, a Specialty.

G. A. BRONDER,

Contracting Engineer and Builder,

229 BROADWAY, NEW YORK.

CONNELLY IRON SPONGE AND GOVERNOR CO.,



Design, Construction and Extension of

COAL OR WATER GAS PLANTS,

Automatic, Balance, High Pressure and Service Governors,

Roots Improved Gas Exhausters,

Iron Sponge, Purifying Material for Gas Purification, Jones Jet Photometers, Pressure Registers, etc.,

INSTALLATION OF SMOKELESS TAR BURNING SYSTEM.

Reinforced Concrete Construction for all Purposes.

Wide Experience in High Pressure Installation and Extension,

GAS SPECIALTIES.

395 Broadway, NEW YORK.

295 West 22d Street, CHICAGO, ILLS.

PARKER-RUSSELL MINING AND MFG. CO.,

OF ST. LOUIS, MO.,

PROPRIETORS OF THE

OAK HILL GAS RETORT AND FIREBRICK WORKS.

ST. LOUIS OFFICE: 417 Pine Street. NEW YORK OFFICE: Aldrich Court, 45 Broadway.

WE MAKE A SPECIALTY OF WATER GAS LININGS AND CHECKER BRICK.

Half and Full Depth Benches of Our Own Design, Containing 6, 8 or 9 Retorts.

SLOPERS.—We have perfected plans of INCLINED RETORT BENCHES, designed to meet conditions prevailing in America, and constructed entirely of American materials.

We Build Benches Complete. Ready for Gas Making. Also,

RETORT HOUSES,

COAL and COKE CONVEYING MACHINERY.

Plans, Specifications and Estimates Cheerfully Furnished.

CORRESPONDENCE SOLICITED.

ALL CONTRACTS MADE AS OF ST. LOUIS, MO.

Gold Medals awarded by the Louisiana Purchase Exposition at St. Louis, for fireclay gas retorts, gas retort benches, firebrick and setting tiles.

Newbigging's Handbook for Gas Engineers and Managers. Price, $6.50. For Sale by A. M. Callender & Co., 42 Pine St., N. Y. City.

JAMES D. PERKINS, President. F. SEAVERNS, Treasurer.

THE PERKINS COMPANY,

228 and 229 Produce Exchange, New York City.

Ocean Mine Youghiogheny Gas Coal,
Old Kentucky Shale and O. K. Boghead.

SHIPMENTS FROM NEW YORK, PHILADELPHIA, BALTIMORE AND NORFOLK.

BERWIND-WHITE COAL MINING COMPANY'S

Ocean Westmoreland Gas Coal.

Offices:
Washington Building, New York.
Betz Building, Philadelphia.

STRICTLY High Grade. . . . .
Carefully Prepared.
For Gas Making or
Heavy Steaming.

A. C. M. AZOY, General Agent, 1 Broadway, New York.

JEFFREY
COAL AND ASH HANDLING
MACHINERY

For Power House Equipment.

Plans and estimates sent, free, with catalogues on

ELEVATING, CONVEYING, CRUSHING, SCREENING, POWER-TRANSMITTING MACHINERY.

The JEFFREY MANUFACTURING CO.,
COLUMBUS, OHIO, U. S. A.

New York. Chicago, Boston, Pittsburgh, St. Louis, Denver.

BINDER for the JOURNAL.

Price, $1.00.
A. M. CALLENDER & CO., 42 Pine Street, N.Y.

POOLE ON FUELS.

THE CALORIFIC POWER OF FUELS.

By HERMAN POOLE, F.C.S.

Second Edition. Price, $3. For Sale by
A. M. CALLENDER & CO., 42 PINE ST., N.Y. CITY.

FRED. BREDEL, President. A. A. MOONEY, Vice-President, O. W. GREENSLADE, Secretary and Treasurer.

FRED. BREDEL COMPANY,
ENGINEERS AND BUILDERS OF GAS PLANTS.

Inclined Benches, own system, Recuperative Furnaces, Exhausters, Exhauster Governors, Condensers, Washers, Coolers, Wet Purifying Plants, Purifiers, Oxide Elevators, Hydraulic and Dry Coke Conveyors.

Special High Grade Material for Recuperative Furnaces.

Licensees for ARROLL-FOULIS Charging and Discharging Machines and FRONHAUSER Coke Conveyors. OFFICE, 405 KEENE ST. MILWAUKEE, WIS.

KELLER ADJUSTABLE COKE CRUSHER.

Strong, Simple, Durable. Will Crush any Size Desired.

C. M. KELLER,
Sec. & Supt. Gas Lt. & Coke Co.,
Columbus, Ind.
Correspondence Solicited

BAXTER & YOUNG,

CONTRACTING AND CONSULTING GAS ENGINEERS.

Examination and Values Ascertained of Artificial and Natural Gas Properties.

COMPLETE GAS WORKS ERECTED.

Artificial and Natural Gas Mains Furnished and Laid.

GAS PROPERTIES PURCHASED.

OFFICE: WAYNE COUNTY BANK BUILDING,
Rooms 201 & 202. DETROIT, MICH.

Geo. Shepard Page's Sons.

GAS MACHINERY.

Correspondence Solicited.

180 Fulton Street, New York City.

DAVID LEAVITT HOUGH,

Consulting Engineer

AND

CONTRACTOR,

PARK ROW BUILDING, N. Y.

EDMUND H. McCULLOUGH, President. F. C. ADAMS, Vice-President. CHAS. F. GODSHALL, Treasurer. HENRY WHARTON, Secretary. C. B. NICHOLS, Assistant Secretary.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Pa.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J., WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

SUN COMPANY,

PRODUCER, REFINER, SHIPPER AND EXPORTER OF

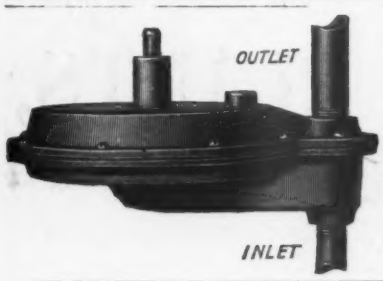
Petroleum and All Its Products.

Pittsburg, Pa., and Philadelphia, Pa.

THE SUN OIL CO.

Gas Oil, Gas Naphtha,
Refined Oil, Lubricating Oils.

Toledo, O., and Pittsburg, Pa.



REYNOLDS HIGH PRESSURE GAS GOVERNORS.

Our Governors Reduce 30 or 40 Pounds Pressure to 2 Inches Water Pressure.

WE MAKE ALL SIZES OF

DOUBLE DISTRICT GOVERNORS, INDIVIDUAL HOUSE SERVICE AND LOW PRESSURE GOVERNORS.

Write for Catalogue and State what you Need.

JOHNSON-REYNOLDS CO.,
ANDERSON, IND., U. S. A.

PRACTICAL HANDBOOK ON

GAS ENGINES,

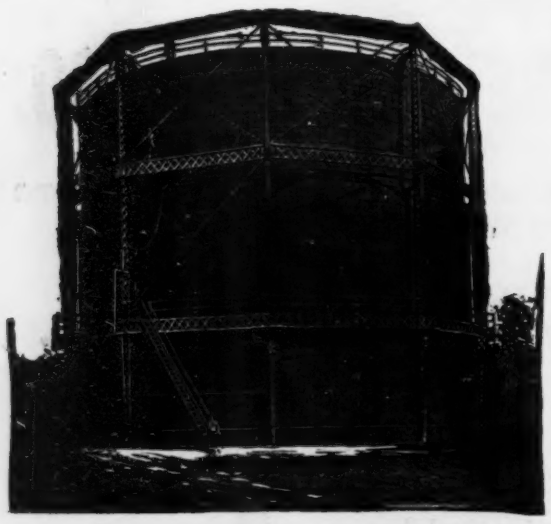
With Instructions for Care and Working of the Same,

By G. LIECKFELD, C.E.

Translated with Permission of the Author, GEO. M. RICHMOND, M.E.

PRICE, $1.00.

A. M. CALLENDER & CO., 42 Pine Street, New York City.



DAVIS & FARNUM MFG. CO.,

Principal Office and Works, Waltham, Mass.

Single, Double and Triple-Lift Gasholders of any Capacity. Tubular, Pipe and Sinuous Friction Condensers of all Sizes.

Steel Tanks for Gasholders, Iron Roof Frames and Floors, Purifying Boxes, Center Seal or Valve Connections, Bench Work, Reversible Lime Trays.

Self-Sealing and Pressed Steel Mouthpiece Lids.

Coke Barrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Works.

Also, Gas and Water Pipe, Flanged Pipe, Sugar House Work, and Special Castings of all Descriptions.

FRANK D. MOSES,

Telephone, 1503 D — TRENTON, N. J., — Telephone, 1503-D

Constructing Engineer and Contractor.

Estimates Furnished on any kind of Work in Connection with Gas or Water Plants.

SPECIAL ATTENTION GIVEN TO THE REMODELLING AND EXTENDING OF THE PROPERTIES OF WORKS NOT UP-TO-DATE.

CORRESPONDENCE SOLICITED.

KERR MURRAY MANUFACTURING COMPANY,

Engineers and Manufacturers

APPARATUS FOR COAL GAS PLANTS,

SINGLE AND DOUBLE-LIFT GASHOLDERS AND STEEL TANKS,

Latest Improved

ROTARY EXHAUSTERS, P. & A. TAR EXTRACTORS, AMMONIA WASHERS,

CONDENSING, SCRUBBING AND PURIFYING APPARATUS.

Street Specials and Valves.

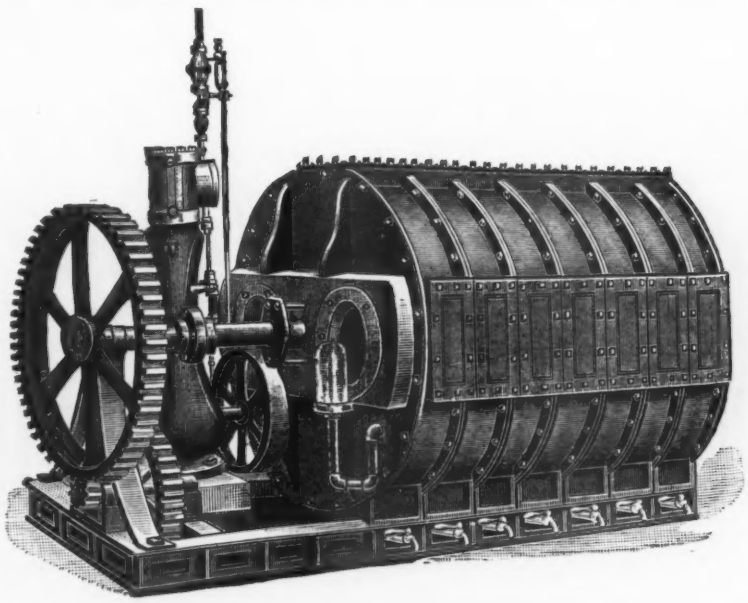
ADDRESS:

KERR MURRAY MANUFACTURING COMPANY, {FORT WAYNE, IND.

BARTLETT, HAYWARD & CO.

BALTIMORE, MD.

Designers and Builders of Gas Works.



Sole Lessees the Wilkinson Water Gas Process.

PATENT STANDARD WASHER-SCRUBBER.

The best apparatus for the extraction of all Ammonia and a large proportion of Carbonic Acid and Sulphureted Hydrogen. The Scrubber has been materially improved and is provided with patented Wooden Segmental Grids, instead of Metallic Disks, thus reducing the weight on shaft and power for operating same.

Coal and Water Gas Installations of the Most Modern and Complete Types.

BENCHES WITH INCLINED RETORTS.

System Stettiner Chamotte Fabrik, Actien Gesellschaft, of Stettin, Germany.

GASHOLDERS OF ALL SIZES.

General Western Agents, THE LLOYD CONSTRUCTION CO., of Detroit, Mich.

QUINTARD IRON WORKS,

N. F. PALMER,

Foot of 12th St. & East River, New York,

MANUFACTURERS OF

GAS APPARATUS.

Complete Works Erected.

FREDERICK W. FLOYD, Engineer.

ALEX. C. HUMPHREYS, M.E., M. Inst. C.E. ARTHUR G. GLASGOW, M. E., M. Inst. C.E.

HUMPHREYS & GLASGOW,

CONSULTING ENGINEERS.

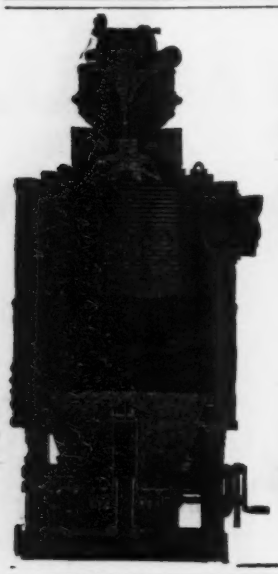
BANK OF COMMERCE BLDG., 31 Nassau Street, New York.

38 VICTORIA STREET, London S. W., England.

ADVICE AS TO EXTENSION AND RECONSTRUCTION OF GAS AND ELECTRICITY PLANT.

COMPLETE EXAMINATIONS MADE.

PROPERTIES PURCHASED.



R. D. WOOD & CO.,

400 CHESTNUT STREET, PHILADELPHIA,

—BUILDERS OF—

Gas Power Plants with Producers,

The best Producers for either Bituminous, Anthracite Coal or Lignite. Less labor required and less waste than in any other Producer. Send for Pamphlet. : : : :

CAST IRON PIPE.

HYDRAULIC TOOLS. HYDRAULIC OPERATING VALVES.

EARTHQUAKE AND FIRE

Destroyed our Perishable Effects and Rendered us Homeless,

BUT HAS

Failed to Destroy our Courage or Valuable Patent Rights Covering the Manufacture of Gas from Oil by our **Celebrated Lowe Crude Oil Water Gas Process.** We will very soon publish new address; meanwhile, just

CALIFORNIA LIGHT AND FUEL CO., San Francisco, Cal.

Do not hold back your inquiries---We are ready for business.

Double Gate Valves.

A LARGE STOCK ON HAND READY FOR PROMPT SHIPMENT.

These valves are provided with double discs or gates, and are tight with the gas pressure on either side of them.

The discs are so arranged as to be free from their seats when being opened or closed, and are operated by a quick-acting mechanism. The valve stem extends outside of the bonnet, and serves as an index, showing whether the valve is closed or open, and the amount of opening. They are made of the following dimensions:

Size.	8 Inches.	10 Inches.	12 Inches.	16 Inches.	20 Inches.	24 Inches	30 Inches.	36 Inches.
Diameter of flanges.....	13 inches.	16 inches.	18 inches	22½ inches.	27 inches.	3[illegible] inches.	37½ inches	44 inches.
Face to face of flange...	12 inches.	12 inches.	12 inches	14 inches.	17 inches.	20 inches.	21 inches.	23½ inches.

For price and other information, apply to

THE CONTINENTAL IRON WORKS,

NEW YORK (BOROUGH OF BROOKLYN).

P. O. STATION G.

Directory of American Gas Companies, 1906.

Price, $5.00.

For Sale by

A. M. Callender & Co. 42 Pine St., N. Y.

THE STACEY MANUFACTURING COMPANY,

ENGINEERS FOR THE CONSTRUCTION OF COMPLETE GAS WORKS

GASHOLDERS AND STEEL TANKS

OF ANY SIZE AND DESCRIPTION,

And All Ironwork and Apparatus Required in a Gas Plant.

Also Oil Storage Tanks, Steel Roofs, Valves, Etc.

Makers of Apparatus for THE CHOLLAR PROCESS OF GAS PURIFICATION.

MAIN OFFICE AND WORKS, - - - Station P, Cincinnati, Ohio.
FOUNDRY AND CAST IRON WORKS, 239 Mill St., Cincinnati, Ohio.

RITER-CONLEY COMPANY,

GASHOLDERS, with or without Steel Tanks.

Purifiers, Condensers, Scrubbers, Oil Tanks, Smoke Stacks.

STEEL ROOFS and BUILDINGS.

PLATE AND STRUCTURAL WORK OF EVERY DESCRIPTION.

GENERAL OFFICE: Pittsburg, Pa. EASTERN OFFICE: 39-41 Cortlandt St., New York City.

WE DON'T CARE WHO MAKES YOUR METERS

If you use the Reeves slot attachments on them. Any good make of meter combined with the Reeves attachment makes the most perfect prepay meter ever manufactured.

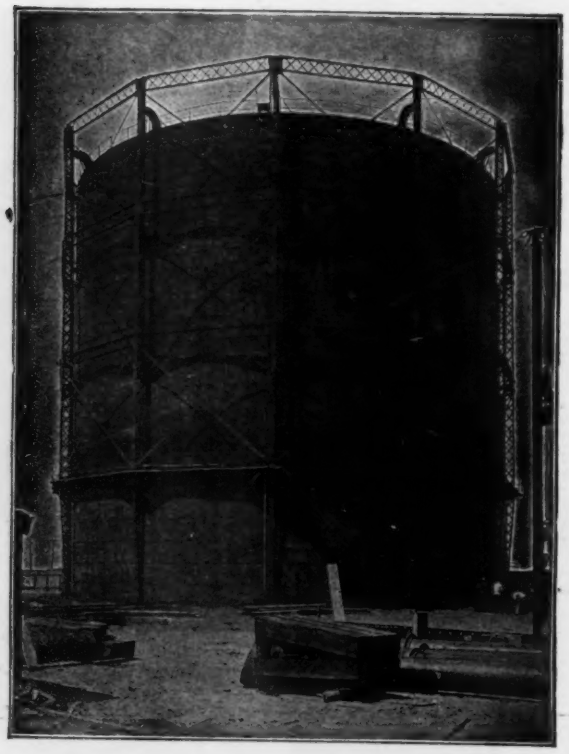
If your meter man does not handle the Reeves attachment we will supply you with the REEVES METER. Large capacity. Other important improvements. Unconditionally guaranteed.

REEVES MFG. CO., New Haven, Conn.

Newbigging's Handbook for Gas Engineers and Managers.

PRICE, $6.50.

A. M. CALLENDER & CO., 42 Pine Street, New York City.



Deily & Fowler,

39 Laurel Street, Philadelphia, Pa.

(ESTABLISHED 1842),

BUILDERS OF

GASHOLDERS,

Single-Lift or Telescopic,

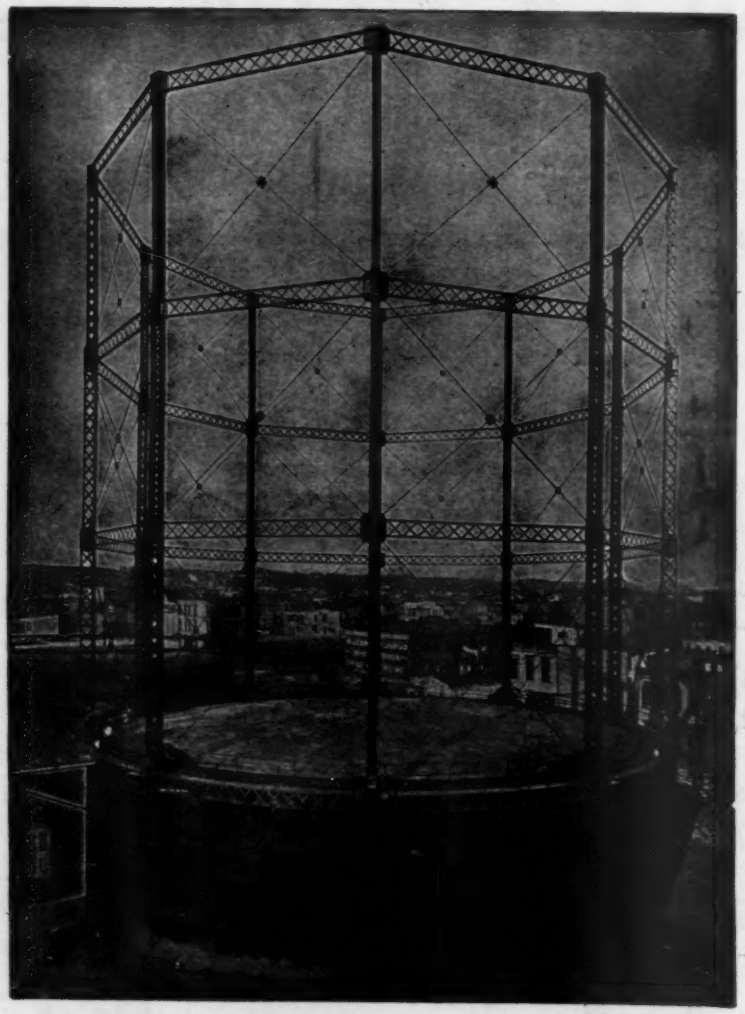
With or Without Steel Tanks.

Oil Storage Tanks, Water Tanks, Etc.

ESTIMATES CHEERFULLY FURNISHED.

CORRESPONDENCE SOLICITED.

The order for this Triple-Lift Holder and Steel Tank was received by the Logan Iron Works from the Union Gas Light Company, of East New York. The contract was completed and the Holder was in actual use in 90 days from receipt of order. Capacity of Holder, 500,000 cu. ft.



LOGAN IRON WORKS,

Brooklyn, N. Y.,

MANUFACTURERS OF

Single or Multiple-Lift

GASHOLDERS,

Complete, with Steel Tanks.

BENCHES, SCRUBBERS,

CONDENSERS,

PURIFIERS, IRON ROOFS,

AND ALL PARTS OF

GAS WORKS APPARATUS.

Contractors for

Complete Works.

FREDERIC EGNER,

Gas Engineer,

NORFOLK, VA.,

May be consulted with reference to estimates of cost for new, or appraising actual value of existing works; utility of proposed or patented processes; relative earning power to capitalization, and management.

ELECTRIC GAS LIGHTING.

How to install electric gas igniting apparatus, including the jump spark and multiple systems for use in houses, churches, theaters, halls, schools, stores or any large building. Also, the care and selection of suitable batteries, wiring and repairs.

By H. S. NORRIE.

Price, 50 Cents. Orders may be sent to

A. M. CALLENDER & CO., - - - 42 PINE STREET, NEW YORK CITY.

Established 1854.

D. McDONALD & CO.,

MANUFACTURERS OF

WET AND DRY METERS, STATION METERS AND METER PROVERS.

ALSO MAKERS OF

THE GLOVER PREPAYMENT METER.

The amount of gas delivered for the coin can be instantly and positively changed without removing the meter or replacing any parts.

The gas registered agrees absolutely with the amount purchased by the coin.

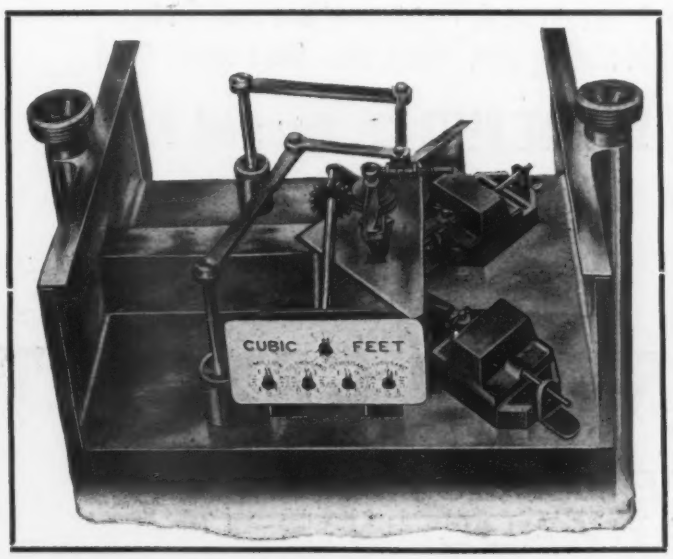
WE HAVE MADE AND SOLD IN THE UNITED STATES

OVER 120,000 OF THESE METERS,

ALL OF WHICH ARE GIVING PERFECT SATISFACTION.

Correspondence Solicited.

561 West Forty-seventh Street, NEW YORK. | 51, 53 & 55 Lancaster Street, ALBANY, N. Y. | Jefferson and Monroe Streets, CHICAGO.



Sectional view of Large Capacity Meter, showing enlarged valves and location of inlet gas channel on top of meter table, making it more accessible and allowing more room for the diaphragms.

A CRITICAL EXAMINATION

of the design and construction of the

Westinghouse Large Capacity

DRY GAS METER

will impress you with its merits.

An actual trial in service will convince you of its superiority.

May we have your trial order?

PITTSBURG METER COMPANY

EAST PITTSBURG, PA.

70 PER CENT.

Of Our Output is

PREPAYMENT GAS METERS.

We have fitted up over **16,000** Idle, Regular Meters with our

PREPAYMENT ATTACHMENT.

Can be attached to any make of meter.

NATHANIEL TUFTS METER COMPANY, 8 MEDFORD STREET, BOSTON, MASS.

MARYLAND METER CO.,

BALTIMORE, North and Saratoga Streets. **CHICAGO, 1307 Railway Exchange.**

CONSUMERS' AND STATION METERS, PRESSURE GAUGES, ETC.

SPECIAL ATTENTION GIVEN TO ALL REPAIR WORK.

"Have you Seen our Complaint Meter?"

WHEN YOU SEND REPAIRS TO US

They can be changed to Prepayment, Prepayment and Beal Straight-reading, or Beal Straight-reading onlv. Good job. Good time. Good people. Write us.

KEYSTONE METER CO., Royersford, Pa.

IMPROVED GAS METERS.

MORE CAPACITY.
PROVE ACCURATE.
REMARKABLE RESULTS.
OVER 16,000 IN USE.
VERY SATISFACTORY.
EFFICIENT AND ECONOMICAL.
DO YOU USE THEM?

PREPAYMENT METERS. **ATTACHMENTS.**

NEW YORK IMPROVED METER CO., 306-308-310 E. 47th St., New York City.

AMERICAN METER CO.,

NEW YORK, ST. LOUIS, PHILADELPHIA, SAN FRANCISCO, CHICAGO,

Wet and Dry Gas Meters, Station Meters, Meter Provers,
Photometrical Apparatus, Gauges,

PREPAYMENT METERS,

REGULAR METERS REFITTED WITH PREPAYMENT ATTACHMENTS.

HELME & McILHENNY,

Established 1848. **1339 to 1349 Cherry Street, Philadelphia, Pa.**

MANUFACTURERS OF

Wet and Dry Gas Meters, Station Meters, Provers, Gauges, Etc.

METERS REPAIRED

PREPAYMENT GAS METERS.

Our Own Patents. Strong. Simple. PROMPT ATTENTION. CORRESPONDENCE SOLICITED.

METRIC METAL COMPANY,

MAKERS OF

GAS METERS for NATURAL and ARTIFICIAL GAS.

Special Attention given to Repairing METERS of all Makes.

FACTORY AT ERIE, PA.

COX'S HIGH-PRESSURE FLUID DISCHARGE COMPUTER.

This Computer solves the following formula, which is applicable to Gas, Air and other elastic fluids, flowing through long pipes with high initial pressures:

$$\text{Discharge in cubic feet per hour at atmospheric pressure} = 33.3 \sqrt{\frac{d^5 \times (p_1^2 - p_2^2)}{L \times w}}$$

Where d = diameter of pipe in inches,
p_1 = absolute initial pressure in pounds per square inch,
p_2 = absolute terminal pressure in pounds per square inch,
L = length of pipe in miles,
w = specific gravity of the fluid when air = 1.

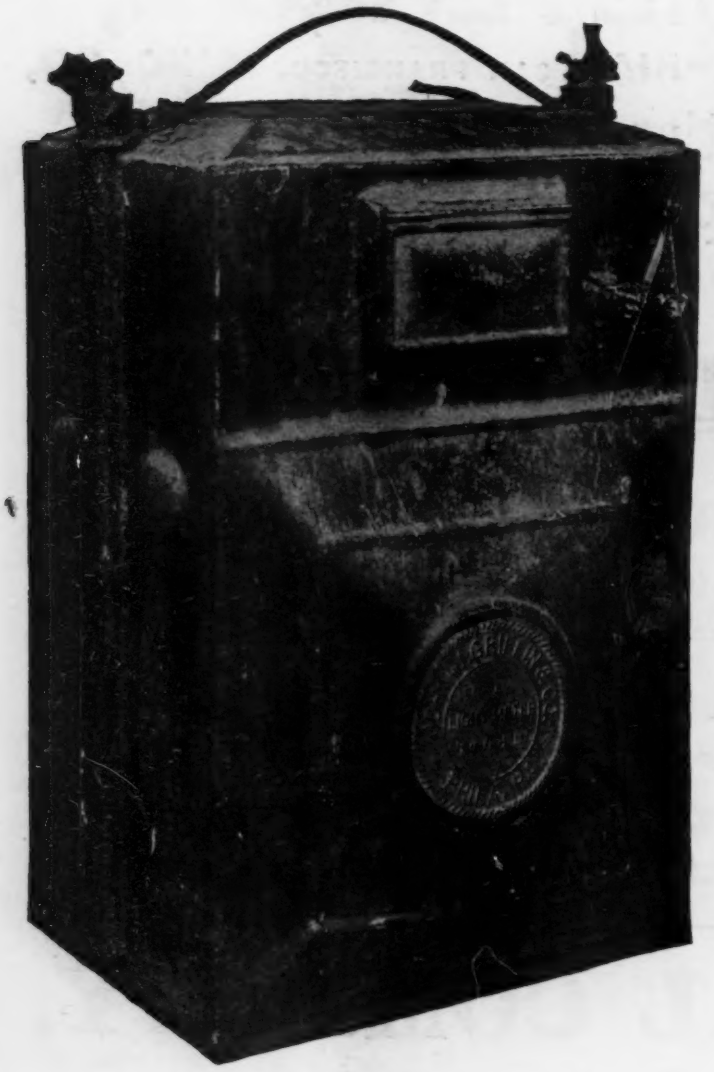
To Find the Discharge from a Pipe and the Required Size of Pipe.

(1.) Set the specific gravity of the fluid opposite the length of pipe;
(2.) Bring the DIFFERENCE of the initial and terminal gauge pressures opposite the SUM of the initial and terminal gauge pressures;
(3.) Opposite any diameter of pipe will **now** be found the discharge in cubic feet per hour at atmospheric pressure; and
(4.) Opposite any desired discharge will also be found the required diameter of pipe.

Price of the Computers, in Cloth Case, 6½ x 8 inches, $5 Each, Net.

A. M. CALLENDER & CO., 42 PINE ST., N. Y.

BEFORE.



This is a photograph of a 3-light regular meter out of a lot of meters received from the Coatesville Gas Co., Coatesville, Pa., to be repaired and converted into prepayment meters.

AFTER.

This is the same meter after it has been repaired and converted into a new prepayment meter.

If you have some ordinary meters to be repaired, send them to us and let us repair and convert them into prepayment meters. They will be a source of satisfaction and profit to you.

JOHN J. GRIFFIN & CO.,

1513 TO 1521 RACE STREET,

PHILADELPHIA.

559 West 47th Street, NEW YORK.

Jefferson and Monroe Streets, CHICAGO.

OVER 250,000 OF THE POSITIVE PREPAYMENT METERS ARE IN USE IN THE UNITED STATES.

SEND FOR OUR BOOKLET.